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Memoirs on Figures and descriptions
Decade II

MEMOIRS

OF THE

GEOLOGICAL SURVEY

OF

THE UNITED KINGDOM.

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Figures and Descriptions

ILLUSTRATIVE OF

BRITISH ORGANIC REMAINS.

DECADE II.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF HER MAJESTY'S TREASURY.

LONDON:

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE:

PUBLISHED BY

LONGMAN, BROWN, GREEN, AND LONGMANS.

1849.

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NOTICE.

PALÆONTOLOGICAL researches forming so essential a part of geological investigations, such as those now in progress by the Geological Survey of the United Kingdom, the accompanying plates and descriptions of British Fossils have been prepared as part of the Geological Memoirs. They constitute a needful portion of the publications of the Geological Survey, and are taken from specimens in the public collections, or lent to the Survey by those anxious to advance this branch of the public service. Although numerous drawings had previously been made, and engravings from them considerably advanced, it was not thought expedient to commence their publication until the large collections of the Survey could be well examined, which a want of the needful space has, until the present time, considerably retarded. This impediment to progress is now being removed, and when the collections can be properly displayed in the New Museum of Practical Geology, in Jermyn Street, it is hoped that the public will have an opportunity of gradually obtaining, in a convenient manner and at small cost, a work illustrating some of the more important forms of animal and egetable life there prese rved, and which have been entombed during the lapse of geological time in the area occupied by the British islands.

The plan proposed to be followed in the work, of which the two Decades now published form a part, is as follows:—

To figure in elaborate detail, as completely as possible, a selection of fossils, illustrative of the genera and more remarkable species of all

classes of animals and plants the remains of which are contained in British rocks; to select especially such as require an amount of illustration which, to be carried out by private enterprise, would require a large outlay of money, with little prospect of a return, and a long time to accomplish, but which, by means of the staff and appliances necessarily employed on the Geological Survey, can be effected at small cost, and with a rapidity demanded by the publication of the Maps and Memoirs of the Survey; thus, it is hoped, affording an aid to those engaged in the sciences with which this work is connected, that they might not otherwise have possessed, and which may materially promote the progress of individual research.

H. T. De la Beche,
Director-General.

Geological Survey Office,
18*th July*, 1849.

BRITISH FOSSILS.

DECADE THE SECOND

The second Decade of representations of British Fossils contains illustrations of the genera and species of Trilobites.

These remarkable animals, belonging to a group of Crustacea, of which we find no traces in strata formed subsequently to the Palæozoic period, were first observed in British rocks. Nevertheless, the investigation of those species found in our country is as yet far from complete. Our recorded knowledge of them is chiefly contained in the works of Sir Roderick Murchison and of Lieut.-Colonel Portlock. In the "Silurian System," only are figures to be found of our commoner species, and in the "Report on the Geology of Londonderry, Tyrone, and Fermanagh," is the only systematic dissertation on their arrangement, which has yet been published in Britain.

During the progress of the Geological Survey through the Silurian districts of Wales and the bordering counties, much new and important material has been collected towards the elucidation of the structure, affinities, and distribution of Trilobites. The following figures and descriptions consequently contain much that has not been before noticed respecting these animals, and new light will be found thrown on several features of their organization.

The Trilobites selected as subjects for this Decade are species of the genera *Phacops*, *Illænus*, *Asaphus*, *Ogygia*, *Calymene*, and *Ampyx*. Some of them are renowned and characteristic forms, such as *Phacops* (*Dalmannia*) *caudatus*, *Illænus* (*Bumastus*) *Barriensis*, *Asaphus tyrannus*, and *Ogygia Buchii*, which, whilst they furnish excellent typical figures illustrating generic or sub-generic groups, acquire an additional

value on account of the abundant details of structure, which, through our extensive collections, we are enabled to delineate; others, as *Ogygia Portlockii*, *Calymene tuberculosa*, and *Ampyx nudus*, are critical species, the history of which has been hitherto imperfectly known; and a third class consists of entirely new forms, such as *Illænus Davisii* and *Olenus micrurus*; the last mentioned trilobite has great interest, having been found in the most ancient fossiliferous strata of the Silurian System, whilst at the same time it constitutes a good representative of the numerous forms of the genus *Olenus*, which occur in the oldest rocks of the Continent.

The descriptions of all the species, with the exception of *Ampyx nudus*, have been drawn up by Mr. Salter, whose attention has for some time been specially directed to Trilobites.

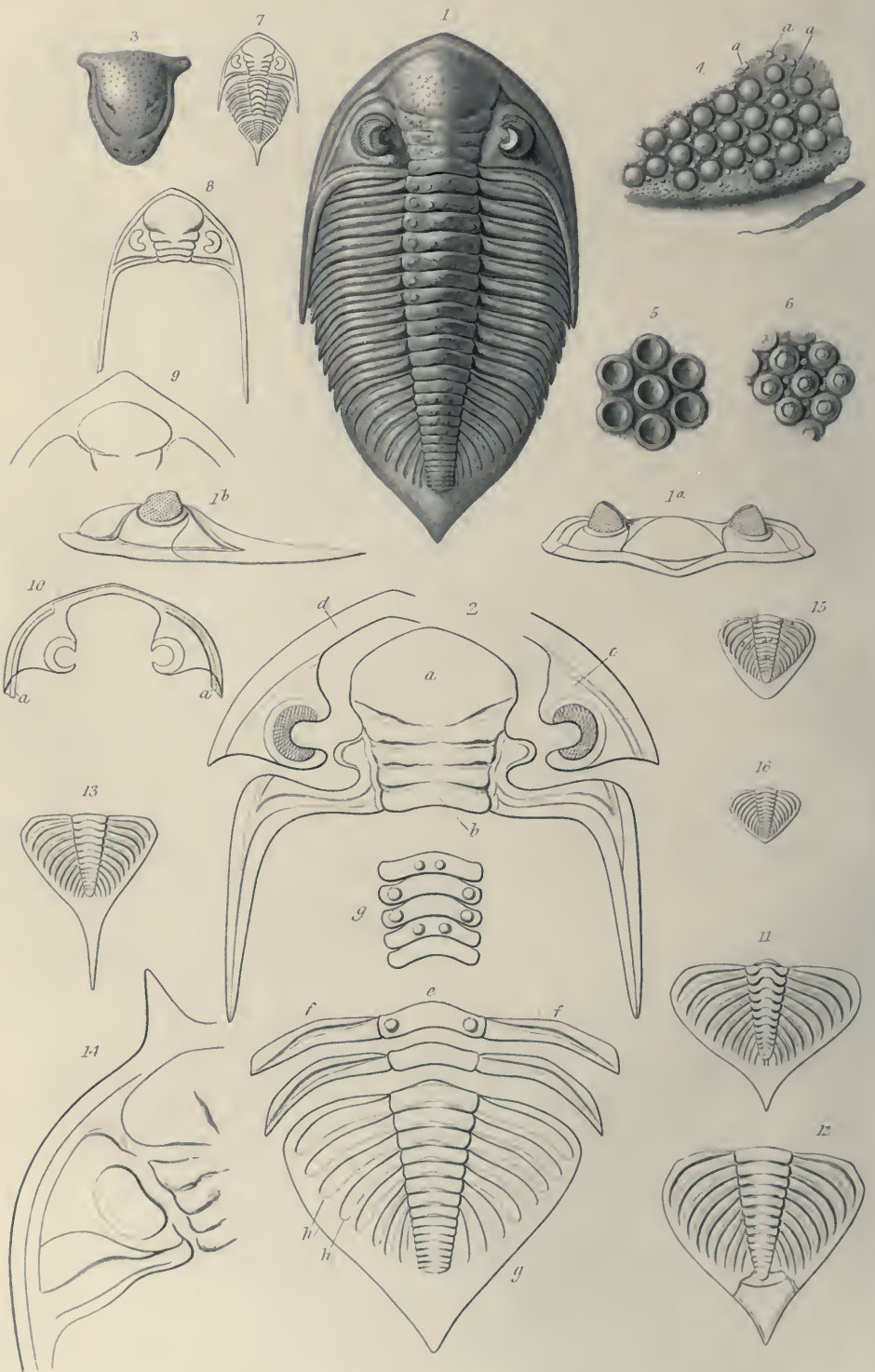
Illustrations of the other British genera of Trilobites are in preparation.

Edward Forbes.

July, 1849.

Geological Survey of the United Kingdom.

PHACOPS
(Silurian)



PHACOPS (DALMANNIA) CAUDATUS — *Brünnich*

BRITISH FOSSILS.

Decade II. Plate I.

PHACOPS CAUDATUS.

[Genus PHACOPS. Emmerich. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Eyes largely facetted; facial suture ending on the outer margin; thorax 11 jointed.]

[Sub-genus *Dalmannia*. Depressed; pleuræ pointed and bent back at a distant fulcrum: glabella not inflated, with three lateral lobes; facial suture within the edge in front; head angles long-spined; hypostome obtusely pointed; tail with a many-jointed axis, and without lateral spines.]

Diagnosis. *P. (Dalmannia) fronte angulato; oculis maximis pyramidatis, e sulco glabellari basali ad tertium et supra extensis; pleuris recurvis, fulcro ad dimidium; caudæ apice mucronato, axi* 11–12 *annulato, costis lateralibus* 7, *rarius* 6, *arcuatis, duplicatis, ad marginem lævem abrupte terminatis.*

Synonyms.—Var. α. *Vulgaris.—Fronte capitis angulato; apice caudæ brevimucronato.*—Plate I., figs. 1 to 12, and fig. 15.

Trilobus caudatus, Brunnich (1781), Kjobenh. Sellsk. Skrifter. Nye Samml., vol. i., p. 392. *Asaphus caud.*, Brongniart (1822), Crust. Foss., t. 2, f. 4 (not 3, f. 9). *Trilob. caud.*, Schlotheim (1823), Nachtrage, 35. 11. *Asaphus caud.*, Dalman (1826), Palead., t. 2, f. 4. Green (1832), Monogr. Trilob. N. Amer., cast 17. Buckland (1836), Bridgw. Treat., pl. XLV., f. 9–11. Murchison (1837), Sil. Syst., pl. 7, fig. 8 *a*. *A. tuberculato-caudatus, ib.*, fig. 8 *b*. *A. caud.* and *A. tuberculato-caud.*, Milne Edwards (1840), Crust. 3, 308. *P. caud.*, Burmeister, Org. Tril., t. 4, f. 9. Ray edition (1846).

Var. β. *Longicaudatus.*—Plate I., figs. 13, 14.—*Axi angustiori, fronte capitis caudâque longimucronatis.*

Trilobite with caudal process, Parkinson (1811), Organic Remains, vol. iii., t. 17, f. 17. *Asaphus longicaudatus*, Murchison, Sil. Syst., pl. 14, figs. 11 to 14. Milne Edwards, Crust. 3, 308. *Phacops mucronatus*, Burmeister, Org. Tril., 113 (exclude all synonyms except Murch.). Ray edit., 95. [*Phac. longicaud.*, Rouallt (1847), Bull. Soc. Geol. Fr., 2nd Ser., 4, 320?].

Description of Var. α.—Four or five inches long; ovate; length as to width varying from 10·6 to 8½·6; thorax longer than either head or tail; the latter about equal to the head, excluding the produced mucro;

axis of the whole body considerably narrower than the sides. Head finely granular all over, semicircular, without the slightly produced snout, or the long, stout, posterior horns, which are broad at the base, and reach the seventh or eighth thoracic ring. Glabella coarsely tubercular, widened above, more than one-third the width of head, the forehead lobe a transverse rhomb, separated by deep, broad, oblique furrows which nearly meet, from the upper side lobes; three lateral lobes and neck lobe all nearly equal in width, and together equalling the forehead lobe, the first and second lie straight across, and leave but a narrow ridge down the middle: strong axal furrows separate the glabella from the triangular cheeks, of the surface of which the large pyramidal eyes occupy a variable proportion; a lunate depression surrounds their outer edge, and this is sometimes extended over more than half the width of the cheek, sometimes barely half, giving a considerable difference in appearance. The length of the eye, which is sharply curved, is uniformly from the first basal furrow to the middle of the upper one; eyelid with a deep concentric groove; lentiferous surface considerably broader forwards, lenses about 240*, 8 or 10 in a vertical row. In the cast, which represents the crystalline layer behind the lenses, the surface is covered with close-set, circular pits, with narrow distinct borders (Fig. 5); in these hollows the moderately convex lenses are set, and in most specimens we see no cornea over them. In two perfectly preserved eyes from Ledbury (Fig. 4), the cornea is, however, present, and contrary to Professor Burmeister's prediction, is distinctly convex over each lens, the intermediate portions being ornamented with tubercles and granules, so as to leave no doubt of its being the true exterior; it is, too, continuous with the other portions of the preserved shell. The cornea does not rise, as in some other species, into elevated ridges between the lenses, but is flat, or in other specimens (Fig. 6), it sinks down between them. In Fig. 4 a lens or two is seen to be undeveloped and very small, among other perfect ones. The facial suture exactly circumscribes the glabella in front, falls perpendicularly to the eye, and arches outwards and upwards from its lower angle to the outer margin of the head, on the lower face of which it extends along the margin further back than on the upper surface (*see* Fig. 10 *a*). The cheek-pieces are united in one (as in all the genus) across the front, and there is no extra piece inserted between them above the hypostome. The latter (Fig. 3) is parabolic, obtusely pointed, the sides a little waved, and the base of attachment extended; a transverse furrow, within the tip, is connected with a marginal longitudinal one on each side, a pair of lateral strong indentations indicate a second furrow

* Buckland, Bridgw. Treat., p. 399, reckons 400. This was probably intended for both eyes.

above. Round the head a strong furrow separates the broad margin, stops at the base of the spines, and there nearly meets the equally strong neck furrow, which is arched down at its end. The margin in front more or less produced into an obtuse point. Thorax with the central lobe not separated by any strong furrow from the pleuræ, which, in English specimens, are half as wide again as the axis; the axis is a little fusiform, not broader than the base of the glabella, and either has the rings smooth, tubercled at their outer edges, or with two tubercles on the central prominent part:—all these variations occur on the same thorax. The front pleuræ are flat for the first half, then gently curved down, and a little back, at the obscure fulcrum; they are divided by a moderately strong curved furrow for most of the length, and their edge sharpened anteriorly (the flat surface not crossing the furrow as in true *Phacops*) for bending. The extremities are truncate, and pointed at the hinder corner; posterior pleuræ with the fulcrum at less than half, much more curved back, and strongly pointed, overlapping the upper corners of the tail. Whole surface of thorax finely granular. Tail with the sides meeting below at nearly a right angle, and produced more or less to a sharp point beyond this; axis not much raised, and gently tapering, ending a little abruptly at some distance from the point; it has 11 or 12 ribs, which are accidentally tubercular, like the thorax, sometimes much so; the sides have six, seven, or sometimes eight narrow ribs, strongly arched down at their ends, where they abut suddenly on the smooth margin; each rib is sharply defined behind, and duplicated on its forward edge by a fine rib, running parallel to it along its whole length. The number of the ribs on the tail appears to be as great in the young animal, judging from the beautiful specimen, Fig. 7, from Mr. J. Gray's collection.

Variations.—The tail margin varies much in width. In fig. 15 it is very narrow, and the apex little produced. Most of the specimens of var. α, in shale or mud (Fig. 11), have the axis of the head and tail narrower than those in limestone (Fig. 12), and the tail itself broader and more mucronate. From Ludlow we have specimens of this form, with all degrees of attenuation in the mucro. The larger head of var. β (Fig. 14), has the outer margin more expanded than in any limestone one yet seen.

Sex.—Some differences are very observable between individuals of this species, as well as of other species and genera, which are possibly referable to sex. We find the male in insects distinguished by large and prominent eyes, extra length of spines, and narrowness or depression of the body; the latter character is sexual in the crustacea. It is natural to look for some sexual distinctions in animals with such marked forms as trilobites have, but an examination of *Serolis*, the external

characters of which, at least, imitate best those of trilobites, does not help out the case. The differences pointed out there by Milne Edwards and Audouin reside in the feet and appendages, not in any general shape, prominence of eyes, or sculpture, and we can, therefore, only surmise from general analogy, that certain individuals with the glabella flattened so as to leave the eyes projecting, the body more depressed, and the spines of the front and sides of the head, or the mucro of the tail more developed, may be males; while greater general convexity, more convex glabella rising nearly as high as the eyes, and a tail not attenuated into the mucro, but simply pointed, may mark the other sex. Fig. 1 we think a female, and in this the eyes seen in front view (Fig. 1 *a*) do not rise much above the glabella, and the body is convex, the tail simply pointed; but in others the glabella is depressed, especially behind, and the front produced. In Fig. 9, supposed to be a male, the produced angular front is shown. Fig. 8 shows the great length the spines of the head sometimes assume.

If *P. longicaudatus*, our var. β, be identical with this species, and it differs in nothing except the greater development of the processes, the probability of this difference being sexual is confirmed, for there occur in the same slabs individuals exactly alike, some with long spines to head and tail, and others without them.

Affinities.—But one European species is sufficiently like ours to render a close comparison necessary. We refer to the *Asaphus mucronatus* (Brongn.), which Professor Burmeister identifies with our var. β; however, he had not seen specimens, and we have them before us. The head of that is regularly convex, the axal and glabellar furrows not deep, the eyes placed further forwards, the margin narrow. The tail is like, but the ribs do not imbricate posteriorly, and the intermediate furrow divides them more equally. The mucro, too, is recurved, as in *P. proevus*, with which, without being identical, it is closely allied. *Asaph. pleuroptyx* (Green, cast 18), has 11 or 12 lateral ribs to the tail, extending below the very narrow axis; but with *P. limulurus* (Green, cast 16), from the Niagara shale, there are so many points of resemblance, that we can hardly persuade ourselves they are distinct. Specimens in the cabinets of Sir C. Lyell and Dr. Bigsby show that the form is more elongate, the pleuræ shorter, the glabella contracted at the base, and the eyes perhaps smaller; the tail narrow, its lateral ribs faint and but little arched, while the extremity of the axis is more prominent. The head wants the strong marginal furrow, and the posterior spines extend but a little way down (to the fifth rib, Hall). While avoiding the risk of a doubtful synonym, we cannot value these mere proportional characters as specific, and believe that a larger series will unite the above and *P. Wetherilli* (Green, cast 20), to the English species.

History.—When Bronguiart made the first scientific attempt to classify trilobites, his genus *Asaphus* confessedly stood as debateable land between *Calymene* and *Ogygia*, but he clearly pointed out that the type of the genus, when restricted, should be *Asaphus cornigerus*, a species possessing smooth eyes and eight joints to the thorax. The characters "Tubercules oculiformes reticulès" were drawn from the present species, and the figures also from Dudley specimens. Dalman followed, without much improving this classification, but Quenstedt, in 1837, clearly separated the group of trilobites with facetted eyes, (meaning thereby with large prominent facets), and Emmerich named it *Phacops*. In the treatise on the "Morphology, Classification, &c., of Trilobites," published 1845, in Leonhard and Bronn's "Neues Jahrbuch," Emmerich pointed out the subdivision *Dalmannia*, making *Ph. caudatus* (Brünn.), its type. Burmeister, however, has thought fit to retain all under *Phacops*, and the characters of one group pass so gradually into those of another, that we prefer following his plan, though in the Memoirs of the Geol. Survey, just published, we have adopted the genus (vol. ii., part 1, page 337.) Sir R. I. Murchison, in 1837, gave figures of the ordinary and the tuberculated forms, and there was quite sufficient to justify him in making the var. *longicaudatus* a species. After observation of many intermediate forms, however, we unite them without much doubt of the propriety of so doing. Green, in 1832, did some service by publishing his casts, and he would have done better had he not permitted them to be carved to make them more plain. Milne Edwards adopted the previously published species in his excellent work on recent crustacea. Professor Burmeister confused the synonyms of this species, by too hastily uniting *P. mucronatus* with our var. β; Dalman had well separated the two in 1826. In uniting, as we have done, the var. β to the typical form, we believe we shall be justified by most naturalists, when the numerous varieties common in every collection are examined with a view to this. The combination of characters is the same in both, and variation in isolated points should always be suspected. The reference of such differences to sex is merely speculative, and will require much observation to confirm.

British Localities and Geological Range.—Distributed throughout the Silurian districts, from the lower LLANDEILO FLAGS TO UPPER LUDLOW ROCK. The shales of Kirkcudbright, Scotland (J. W. S.); rarely in the Coniston limestone, Westmoreland; quoted also by Prof. Sedgwick, from Coldwell, ditto (Geological Journal); this is a mistake, as is also the quotation in the list of fossils, *ib.*, vol. i., p. 20. Upper Silurians of Denbighshire (J.W. S.). Near St. Clairs and Narberth, in Llandeilo flags. Marloes Bay, Pembrokeshire (Phillips). Dynevor Park, and numerous localities south and west of Llandeilo; also Rhiw-rhwych and

Cefn Llwydlo, north of Llandovery (J. W. S.) Everywhere in upper Silurian rocks, Herefordshire and Shropshire (Murchison, "Sil. Syst.") Especially abundant in Dudley limestone and shales. Usk, Monmouthshire; in Ludlow and Wenlock rocks (J. W. S.) Horse-shoe Farm, Tortworth; Huntly-hill, Gloucestershire; Caradoc sandstone; Woolhope limestone and upper Silurians of Woolhope, Abberley, and Malvern districts. (Geol. Surv.) Not yet found in Ireland.

Var. β.—Marloes Bay, and St. Ishmael's, Pembrokeshire (Phillips). Cwmdwr, Brecknockshire (J. W. S.). Brindgwood Chase, in Ludlow rocks; Burrington, in Wenlock shale; near Ludlow, Aymestry, and Nash Scar, Herefordshire ("Sil. Syst.") Usk, Monmouthshire, from Wenlock shale to upper Ludlow rock; Abberley and Malvern (Phillips).

Foreign Distribution.—In Gottland, upper Silurian, rare (Dalman and Hisinger.) Ripley, Ohio (Green;—the localities quoted from Canada are erroneous, Dr. Bigsby's specimens being of quite different species, but one, which is probably the true species, was found by him at Gaspè, Gulf of St. Lawrence).

Explanation of Plate I.

Fig. 1. Perfect specimen, in Mr. Tennant's cabinet, probably from Dudley.

Fig. 1 *a*. Front view of head; 1 *b*, side view.

Fig. 2. Same, dissected; *a*, front lobe or forehead; *b*, spira or neck lobe; *c*, cheek or wing; *d*, margin; *e*, axis of body ring; *f*, fulcrum of ditto; *g*, part of the axis of a tuberculated specimen; *h*, intermediate ribs of the tail. (These are the indications of separation between the segments.) The *g* at the tail margin should be omitted.

Fig. 3. Hypostome from Ledbury.

Fig. 4. Magnified view of surface of eye, the cornea tuberculate between the convex portions which cover the lenses. At (*a a*), some small abortive lenses are seen. Ledbury.

Fig. 5. A cast of the interior of the eye, the cornea having been removed, and the lenses fallen out. Vinnal Hill, Ludlow.

Fig. 6. An eye, with very prominent lenses, which are partly visible, where the cornea has been broken away. Ledbury.

Fig. 7. A fine young specimen, with rather prolonged tail. Dudley, Cabinet of Mr. John Gray.

Fig. 8. Specimen, with vastly prolonged head spines. Dudley Museum.

Fig. 9. Head, with produced front (male?) Bodenham, Woolhope.

Fig. 10. Cheeks united across the front, and separated from the rest of the head along the facial suture. The course of the suture beneath (at *a*) is rather different from that of the upper side. Vinnal Hill, Ludlow, a rich locality.

Fig. 11. Tail, with the axis narrow and the point prolonged. Intermediate between *P. caudatus* and the var. *longicaudatus*. Vinnal Hill.

Fig. 12. Tail of ordinary form. From Wenlock limestone of Clineher's Hill, South Malvern.

Fig. 13. Tail of var. β, *longicaudatus*. Craig-y-Garcyd, Usk, in Wenlock shale.

Fig. 14. Head of same variety. Burrington, Ludlow.

Fig. 15. Tuberculated (diseased?) tail, with very narrow border. Rock Farm, May Hill.

Fig. 16. Accidentally introduced; it belongs to the species next described. Long's Quarry, Tortworth.

Other British Species of Phacops, of the Section Dalmannia.

1. *P.* ——— *sp.* [fig. 16 in Pl. I.]

P. lævis, capite quam in P. caudato, nisi lobis glabellæ tumidioribus;—caudâ triangulari, ferè æquilatera, convexa, apice acuto haud mucronato, axi 13–16 *annulato, costis lateralibus* 10–12, *simplicibus, vix curvatis, ad marginem æqualem angustum abruptè terminatis.*

Length of tail 1½ inches. There are but imperfect heads in the collections of the Geological Society and Geological Survey. The characters of the tail distinguish it from *P. caudatus;* it has much more numerons ribs, which are but little curved, and not duplicate; the margin, too, is eqnal all round, not expanded or mucronate at the end. Young specimens have not the full number of ribs, and a few of the upper ones are slightly divided. The most prominent analogy is with *P. Hausmanni*, Brongn.; but that is strongly tuberculate, almost spinous, all over. *P. pleuroptyx* (Greeu), is also like, but has the lateral ribs duplicate. The species of this group so closely resemble each other, that we dare not give a name. Should it prove new, it might be called *P. Weaveri.*

Localities.—Caradoc sandstone of Long's Quarry, Damory Bridge, and Charfield Green, Tortworth, Gloucestershire; (all small); Woodford Green, ditto; (large).

2. *P. obtusicaudatus.*

P. capite quam in P. caudato, sed latiore;—caudâ brevi, lato, subtriangulari, apice angulato, obtuso; axi lato, convexo, 11–12 *annulato, obtuso; costis lateralibus* 9, *duplicatis, rectis, ad marginem angustum æqualem abruptè terminatis.*

We merely note this curious species here; it will be figured and described in Prof. Sedgwick's work ou Westmoreland.

Locality.—Coldwell, in flags above the Coniston limestone, Westmoreland.

3. *P. truncato-caudatus*, Portlock, Geol. Rep. Tyrone, &c., pl. 2, f. 1–4, and *Paradoxides? Bucephali* var., pl. 1, f. 8 (hypostome).

P. granulatus, capite antice truncato, oculis maximis subdepressis; pleuris obtusis, fulcro ab axi valde remoto; caudæ axi 18-*annulato, angusto, costis lateralibus* 14–16, *apice emarginato.*

This interesting species, while in the large eyes and strong head spines, numerous joints of the tail, and general depressed form, it is nearly allied to the other *Dalmanniæ*,—yet indicates more than any other the close affinity of this section with *Phacops*, for the facial suture is only just within the margin, the tail rather rounded than produced, the pleuræ have their furrows strong and curved forwards at their obtuse ends, and they are bent down at the distant fulcrum, so as to be much better fitted for rolling up than is usual in *Dalmannia.* For the first half of the thorax they are scarcely at all bent back from the fulcrum; the posterior pleuræ are more in the usual way. The hypostome is very much extended at its base, is pointed, and has two pair of oblique fnrrows.

Localities.—Lower Silurian. Tyrone, Ireland. Coniston, Westmoreland. Horderly, Shropshire.

Var. β *affinis. Caudæ axi latiore—Dalmannia affinis*, Salter, in Memoirs of the Geol. Survey, vol. ii., part 1, pl. 5, f. 5.

It is to be feared there are not sufficient grounds for separating this species, founded only on caudal shields. A tolerably perfect tail in Mr. D. Sharpe's collection, and an imperfect one in the Survey Collection, have the axis considerably wider than in Portlock's originals. Specimens, however, iu Sir R. I. Murchison's cabinet, show intermediate characters.

Localities.—Lower Silurian. Llandowror, Caermarthenshire. Coniston, Westmoreland.

Phacops is a widely distribnted genus or group of trilobites, remarkable for the large facets of the eyes,—the distinct trilobation of head, thorax, and tail, the furrows separating

the lobes being strong and deep,—and for possessing eleven joints in the thorax, a number apparently never deviated from. Besides these, in a large part of the genus the convex form of head and tail, the curvature of the segments of the thorax, and the sharpening of their anterior margins, eminently fit the animal for rolling up into a compact ball; for this purpose it is as completely constructed as *Calymene*, while it has the advantage over the latter genus in its large organs of sight. It may be considered as the very type of a Trilobite, possessing all the characteristics of the tribe, with a compact and elegant form. And while the whole group is so bound together by common characters as to render it difficult to separate it into distinct genera, there is a great variation of form among the numerous species. Quenstedt, and after him Emmerich, united them all, and Professor Burmeister has not ventured to dismember the genus. Subgenera, however, have been frequently pointed out, and the groups so formed are very natural. We have—

1st. Convex species, with the pleuræ rounded at the end, and sharpened for rolling; the glabella inflated, and with but one lobe at the base; the facial suture beneath the margin of the head in front; the head angles rounded, the tail of few joints.—*Portlockia*, M^{c}Coy.

2nd. Moderately convex, with the pleuræ rounded; the glabella not inflated, but with (3) distinct lateral lobes; facial suture marginal in front; head angles rounded, or variously produced, tail few (less than 11) jointed, rounded or pointed.—*Phacops*, Emmerich.

3rd. Characters as given above.—*Dalmannia*, Emmerich.

4th. Flattened; pleuræ pointed, or even mucronate; glabella and facial suture as in Dalmannia; head angles long-spinous; tail many-jointed, the margin produced into spines.—*Cryphæus*, Green; *Pleuracanthus*, Milne Edw.

Odontochile, Corda, is synonymous with *Dalmannia*, and his *Asteropyge* and *Metacanthus* apparently with *Cryphæus*.

The genus is found in all Silurian strata, and existed till the commencement of the Carboniferous system. The distribution of the various subgenera in Britain is as follows:—

Portlockia is found in all the above strata. *P. Stokesii*, Milne Edw., and *P. sublævis*, M^{c}Coy, Silurian. *P. Latreillii*, Steininger, *P. granulata* and *P. lævis*, Munster, Devonian and lower carboniferous rocks, Devonshire and Cornwall.

Phacops is Silurian. *P. Odini*, Eichwald, *P. Brongniartii*, *P. Dalmannii*, *P. Jamesii*, Portlock, Lower Silurian. *P. Downingiæ*, Murchison, Upper and Lower Silurian.

Dalmannia, Upper and Lower Silurian.

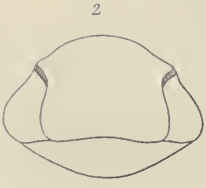
Cryphæus, Green [*C. callitelus*, &c., so named before the definition of Milne Edwards' genus, *Pleuracanthus*], Devonian. A specimen of *C. arachnoides*, Goldfuss, found at Torquay, Devonshire, is in the collection of Mr. D. Sharpe.

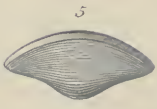
J. W. Salter.

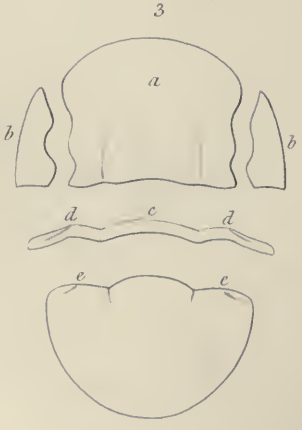
June, 1849.

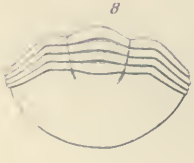
Geological Survey of the United Kingdom.

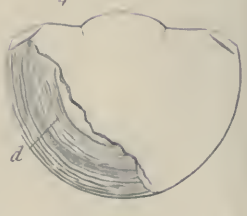
ILLÆNUS
(Silurian)











ILLÆNUS DAVISII —— *Salter.*

BRITISH FOSSILS.

Decade II. Plate II.

ILLÆNUS DAVISII.

[Genus ILLÆNUS. Dalman. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Head about a quarter of a sphere; eyes smooth, remote; facial suture ending on the posterior margin behind the eye, marginal or submarginal in front; hypostome entire, separated from the facial suture by a transverse rostral shield; thorax segments 9 or 10.]

[Subgenus *Illænus*. Axis of thorax separated from the pleuræ by distinct furrows; fulcrum not close to the axis.]

Diagnosis. *I. capite pygidioque æqualibus; oculis parvis prope sulcos axales, a margine occipitali diametrum et plus distantibus; thorace segmentis* 10, *axi pleuris æquali; fulcro in segmento primo ad axin approximato, in postremo dimidium pleuræ vix attingente.*

Synonyms. *I. Bowmanni* [Specimens from Rhiwlas only], Salter (1845), in Geol. Journ., vol. i., p. 20; also p. 8. *Illænus crassicauda*, Sharpe (1848), Geol. Journ., vol. iv., p. 149.

Description.—Length 2½ to 3 inches. General form oval, very convex; length to width 17 : 10; the head and tail nearly equal in length; the thorax about two-thirds the length of either, and strongly trilobate; the axal furrows are carried less than half way up the head, and but a very little way into the tail: head a quarter of a sphere, and regularly convex, not peculiarly gibbous behind, where it is divided into three nearly equal parts by the slightly converging axal furrows; these curve out again opposite the eye. The eye is of moderate size, gently lunate, placed much nearer the furrow than the outer edge, and fully its own length or more from the posterior margin. There is no internal ridge at the place of the neck furrow. Facial suture divergent above the eye, and slightly so below it, so as to cut the margin beneath the most prominent curve of that organ. Rostral shield shuttle-shaped, covered by transverse, close, sharp lines, the lower edge a little produced and overhanging. Hypostome .....? Thorax of 10 narrow segments, the axis strongly marked, convex, and subfusiform; wider than the pleuræ in the forward segments, in the last only equal to them. The fulcrum is very near the axis in the first segment, and in the last one is placed less than half way along the pleuræ, which are sharpened anteriorly beyond

this point. The anterior segments are bent down slightly, and also a little backward at the fulcrum, while the posterior ones are only bent downwards. Tail semicircular and moderately convex; the axis indistinctly marked out by two deep impressions, which sometimes form short rapidly-converging furrows; the upper corners are bent sharply down beyond the fulcrum, in order to pass freely under the thorax-rings in rolling; the incurved under portion is concentrically striate as usual, not broad nor indented by the termination of the abdominal axis.* General surface of the head not well known; a few wandering lines appear on one specimen near the margins of the cheeks; the thorax rings are unornamented: the general aspect is smooth.

Variations.—The axis in some specimens is narrower in proportion to the pleuræ (fig. 7).

Affinities.—This species requires close examination to distinguish it from several others. *I. Bowmanni* has only nine rings to the very short thorax. The *Ill. crassicauda* has a head very gibbous behind, and longer than the tail; the eyes placed at less than their own length from the neck margin, and remotely from the axal furrows; the tail, which has the axis distinctly marked all round, is scarcely longer than the thorax, and the latter has its axis broader and flatter than in our species; the fulcrum of the pleuræ not close in front, and at a full half behind; the incurved under portion of the tail is far broader and less concave, and its lines of growth meet at an angle in the middle; this last portion is, however, not always visible for the purpose of comparison. The whole surface, too, is covered with strong, sharp lines, which are certainly not conspicuous upon *Ill. Davisii*, though the latter is not quite smooth. *Ill. perovalis* (Murch) is a more elongate oblong species; the axis of the tail is very narrow, more so than in our narrowest variety, extends one-third down its length, and is circumscribed; the incurved portion of the tail is broad. It is not at present justifiable to connect even this latter with *Ill. crassicauda*, although it agrees more nearly with it than with any other species.

History.—Apparently it was not known till Professor Sedgwick and myself collected it at Bala, in what was then considered a peculiar band of limestone, and it was too hastily identified with the *Ill. Bowmanni* (Mem. Geol. Surv., vol. ii., part 1, pl. 8, figs. 1, 2, 3), and as such published in the list of Welsh fossils given in the 1st volume of the Geol. Journ., p. 20: the Rhiwlas locality belongs to the present species. Mr. D. Sharpe, in noticing the probable occurrence of *Ill. crassicauda* in America, states that this fossil is found at Rhiwlas; the present species only is intended, and Mr. Sharpe differs with me as to its specific value.

* This indentation is frequently to be seen in *Asaphus;* it is strong in *Illænus crassicauda*, Dalm.

British Localities and Geological Range—Llandeilo Flags only.—Abundant in the Bala limestone at Rhiwlas, at the foot of the lake, and also at other localities in the immediate neighbourhood both north and east of the lake (Coll. of Geol. Survey). It appears, however, to be but local, and its place is taken through many other parts of North Wales, and all through South Wales, by the *Ill. Bowmanni*. It probably occurs in the lower Silurian limestone of Wrae, near Broughton, Peebleshire; some fragments were found there by Mr. James Nicol (Geol. Journ., vol. iv., p. 206), which are with doubt referred to this species, as also is another portion of thorax found in the limestone of the Stincher river, Ayrshire, by Mr. Carrick Moore (*ib.*, vol. v., p. 13).

Explanation of Plate II.

Fig. 1. Nearly perfect specimen. Rhiwlas, Bala; in which locality all, except figs. 6, 7, were found. Fig. 1*, side view of ditto.

Figs. 2, 2*. Front and side views of a rolled-up specimen; the want of gibbosity in the head is shown in the side view.

Fig. 3. Dissected figure. *a*, central lobe; *b b*, wings, upper side; they extend further inward on the under side; *c*, axis of a middle thorax segment; *d d*, fulcra; *e e*, fulcra of tail.

Fig. 4. A separate tail, showing the incurved under portion, *d*, where the upper crust is broken off.

Fig. 5. Rostral shield, often found separate.

Figs. 6, 7. Tails of young specimens, showing the further extension of the furrows at that age. Llechwedd ddu, Bala.

Fig. 8. Variety with narrow axis. The tail has been compressed from below, and appears too small. Rhiwlas.

British species of *Illænus* proper.

* With 9 body-rings.

1. *I. Bowmanni*, Salter, Mem. Geol. Survey (June, 1848), vol. ii., part 1, pl. 8, f. 1–3; *I. centrotus*, Portlock (1843), Geol. Rep., pl. 10, f. 3–6, and probably f. 9.

I. capite magno, angulis posterioribus obtusis; oculis remotis, ad marginem occipitalem approximatis; thorace caudâ breviore.

Locality.—Llandeilo flags, North and South Wales; Kildare, Ireland.

** With 10 body rings.

2. *I. Davisii*, as defined in our preceding description.

3. *I. Portlockii*, Salter; *I. crassicauda*, Portlock (1843), Geol. Rep. Tyrone, &c., pl. 10, f. 7, 8 [*Thaleops ovatus*, Conrad; Hall, Paleont. New York (1848), pl. 67, f. 6 *b*.?

I. capite magno, cauda parva, subtrigona; oculis remotis [prominulis?]; thorace segmentis 10, *axi lato, pleuris abrupte deflexis et reflexis ad fulcrum, quod ad dimidium pleuræ uniusquisque positum est; caudâ depressa, subtriangulari, angulis extremis latè truncatis.*

That this neat species is not *I. crassicauda* is very clear; the shape of the tail, and the abrupt backward bend of the pleuræ, almost at right angles, distinguish it easily; the fulcrum is as far outward in the first segment as the last, an unusual character. We have not seen specimens of *I. ovatus* (Conrad); Hall's figure of that species (loc. cit., pl. 67, f. 6 *b*) much resembles ours in the tail; but if his two specimens be correctly drawn, he

must have figured two species under the name. We cannot therefore identify the Irish fossil with his, especially as the decided bend in the pleuræ is not given in his figure; and we dedicate the species to Col. Portlock, who has so well elucidated the trilobites of Ireland. Our description is drawn from his specimen.

Locality.—Lower Silurian rocks of Tyrone, Ireland.

4. *I. perovalis*, Murchison, Sil. Syst. (1839) t. 23, f. 7.

I. capite gibboso, oculis remotis; thorace quam caudâ longiore, segmentis 10, *axi angusto; pleuris paulo reflexis ad fulcrum, quod pleurarum ferè omnium ad tertium positum est, caudæ axi angustissimo, circumscripto.*

In the young specimen figured the eyes are not seen, but they must be nearly as distant from the axal furrow as the width of the central lobe; the axis of the thorax is much narrower than the pleuræ—this is maintained in the adult; the fulcrum at about one-third in the first segment, in the next a little farther out, and from thence at an equal distance in all the segments. Tail in youth more than a semi-circle, shorter than the thorax, with the axis very narrow, circumscribed, and reaching about half-way down; in the older state it forms about a semi-circle, is flattened, and the axis does not reach so far. The end of the axis does not indent the broadish incurved margin of the inferior side; it does so in *I. crassicauda*, which has a shorter and subtruncate convex tail, a much broader axis to the thorax, and the eyes not nearly so remote. We have not specimens perfect enough to characterize *I. perovalis* fully, but enough to show that it ought not at present to be connected with the Swedish species.

Locality.—Llandeilo flags of the Corndon Mountain, Shropshire.

5. *I. ocularis,—n. sp.*

I. capite semicirculari, utraque acutangulo, lobo centrali angusto; oculis magnis, approximatis, a cervice vix dimidium diametri remotis: thoracis axi pleuris æquali, his ad fulcrum deflexis et paulum reflexis; pygidio —— ?

A species so remarkable among the trilobed division of *Illænus*, for the size of the eye, that we have ventured to name it—we cannot recognize it among published species.

Locality.—Llandeilo flags, county Kildare, Ireland.

6. *I. Murchisoni*, Salter. *I. Rosenbergii*, ib., Mem. Geol. Surv., vol. ii., pt. 1, pl. 5, f. 6–8.

I. capite caudâque magnis, thorace brevi, anterius contracto; capite utrâque acutangulo, oculis ad sulcos approximatis, diametrum suum a cervice remotis; thorace axi latissimo distincto, pleuris anterioribus brevissimis.

A species connecting the true *Illæni* with *Bumastus*, having a very wide axis and very narrow front pleuræ. The axis, however, is really distinct, and the fulcrum not close to it. There is reason to believe that the *I. Rosenbergii*, to which these specimens were referred before, is a very large specimen of *I. crassicauda*: as Pander and Burmeister have previously stated. This fine *Illænus*, from near the classic town of Llandeilo, we dedicate to Sir R. I. Murchison.

Locality.—Llandeilo flags of Llandeilo, South Wales.

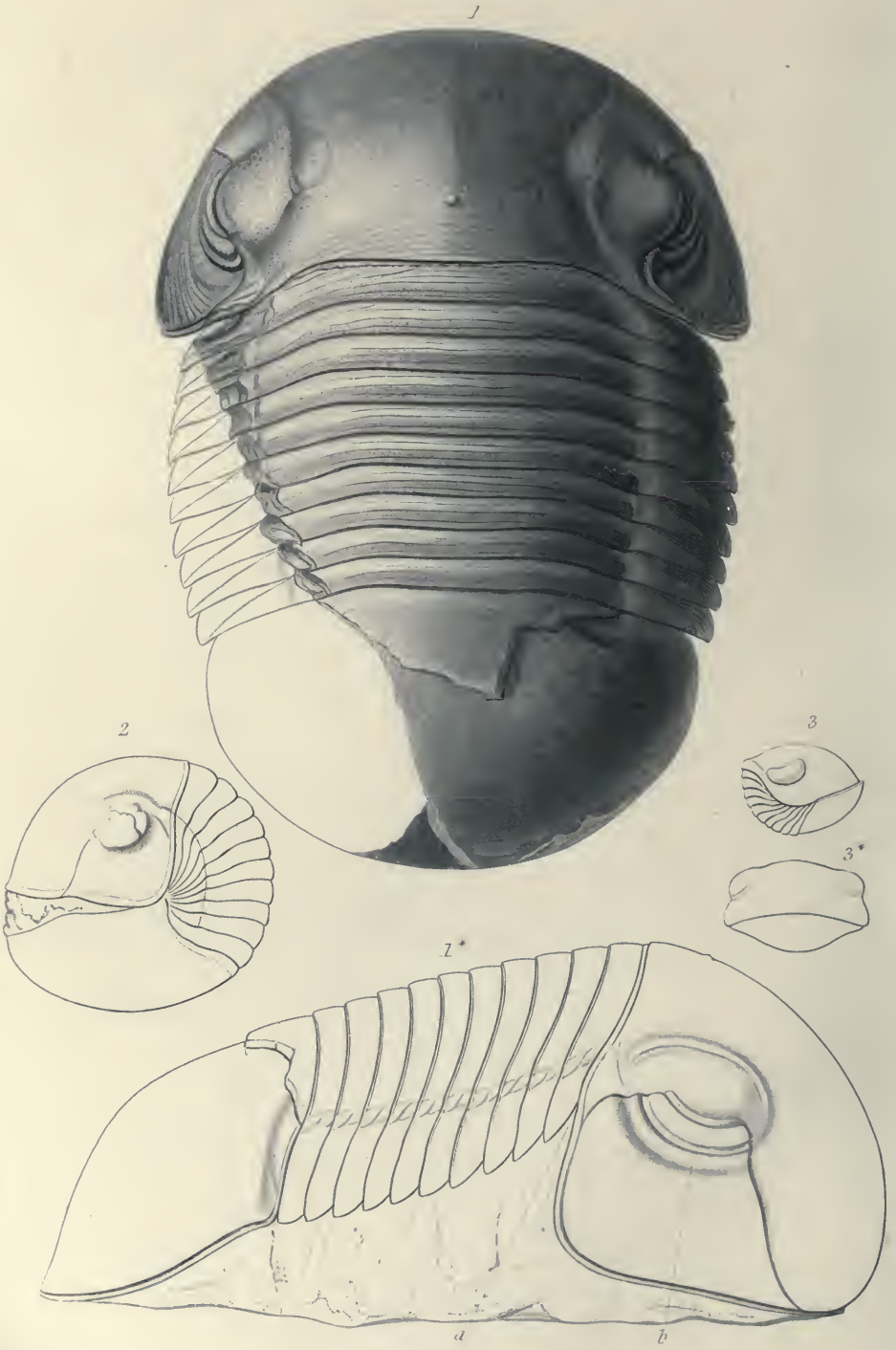
Notwithstanding its great similarity in external characters to *Nileus*, *Illænus* is essentially distinguished by the possession of a rostral shield, a portion so designated by Burmeister, and peculiar to *Illænus* and *Calymene*. This shield appears to be a plate inserted between the two cheek-pieces, and separates the hypostome, or labrum, from the facial suture. In *Asaphus* the cheek-pieces are united across, or in some divided merely by a vertical suture. *Ill. centrotus* (Dalman) has long head-spines, and in this differs from most species of the genus, though some others are angular at the corners. Pander, and after him Sars, described the hypostome; it is simply oval, and by no means notched, as in *Asaphus*.

The genus commenced in the Llandeilo flags, and continued to the end of the Silurian system. We think there is not good evidence of its longer duration, though Munster cites one or two species from Devonian rocks in Germany.

June, 1849. J. W. Salter.

Geological Survey of the United Kingdom.

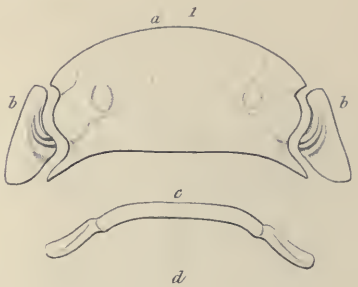
ILLÆNUS
(Silurian)

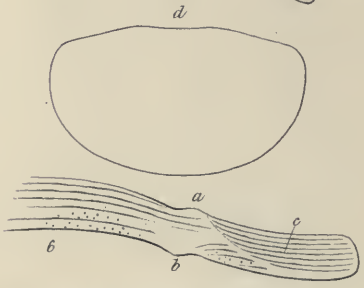


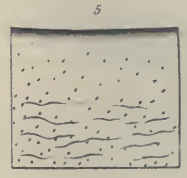
ILLÆNUS (BUMASTUS) BARRIENSIS — *Murchison*

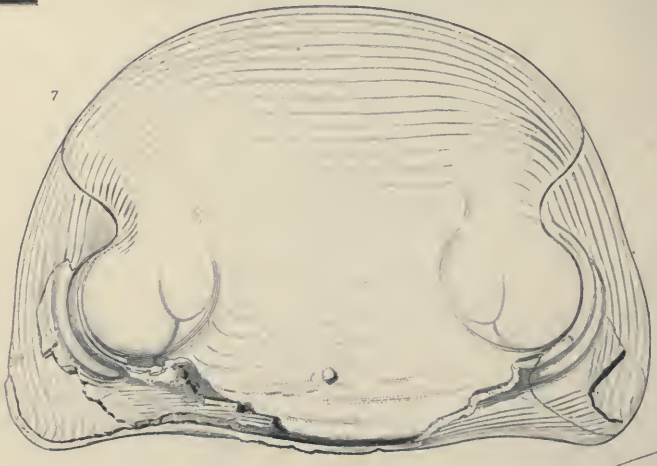
Geological Survey of the United Kingdom.

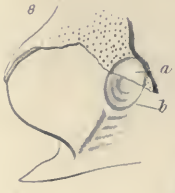
ILLAENUS
(Silurian)

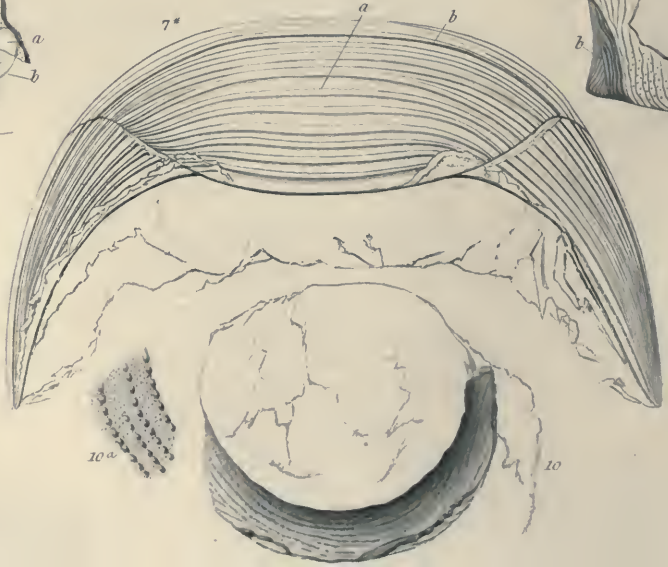


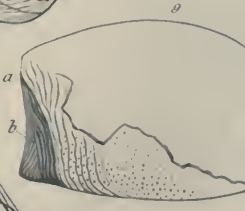












BRITISH FOSSILS.

Decade II. Plates III. and IV.

ILLÆNUS BARRIENSIS.

[Genus ILLÆNUS. Dalman. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Head about a quarter of a sphere; eyes smooth, remote; facial suture ending on the posterior margin behind the eye, marginal or submarginal in front; hypostome entire, separated from the facial suture by a transverse rostral shield; thorax rings 9 or 10.]

[Snb-genus *Bumastus*. Thorax with 10 rings, not trilobate; the axis very broad, reaching to the fulcrum.]

Diagnosis. *I. (Bumastus) ovali-oblongus, valde convexus, crustâ crassa; capitis sulcis axalibus remotis; oculo magno prominente, vix dimidium longitudinis suæ a cervice remoto, palpebra* valde convexâ; thorace articulis* 10, *haud trilobato.*

Synonyms. "A new species of Trilobite," F. Jukes (1829), in Ann. Mag. Nat. Hist., vol. ii., p. 41, figs. 8, 9, 10; "*probably Isotelus*," J. D. C. Sowerby, *ib.*, p. 45; Silliman, Amer. Journ. of Science (1832), vol. xxiii., 1, p. 203. *Bumastus Barriensis*, Murchison (1839), Sil. Syst., pl. VII. *bis.*, fig. 3; *ib.* XIV., f. 7; Emmerich (1839), Dissert. 33. *Nileus?* (*Bumastus*) *Barriensis*, Milne Edwards (1840), Crust., vol. iii., p. 295. *Ill.* (*Bumastus*) *Barriensis*, Burmeister (1842), Org. Tril., 120; Ray edition (1846), 104. *Bu. Barriensis*, Hall (1843), Geol. Report, New York, No. 10, f. 4; No. 19, f. 2. [*Nileus glomerinus*, Dalman, Arsberätt. (1828), p. 136; Hisinger (1837), Leth. Suec. 16?]

Description.—Oblong-oval and very convex; the three divisions, head, thorax, and abdomen, nearly equal. Head a quarter of a sphere, more pointed in front in the young specimen than in the adult, in which it becomes obtuse. The surface of the head is even, and but slightly marked by short converging distant axal furrows into glabella and cheeks. Terminating these short furrows, and immediately above the prominent upper eyelid (*palpebra*) is an oval space, sometimes flat of depressed, and sometimes a little convex, where the crust is thickened interiorly, and on which the puncta that occur so commonly on the other portions of the crust are absent in some specimens,—its nature

* Dalman uses the term "*lobus palpebralis*" for the covering plate or eyelid: its variations are often characteristic.

we do not know. Eye strongly lunate, long, narrow, smooth, and supported by a very strong fold of the cheek, which forms a sort of lower eyelid, and is most developed in age. Cornea apparently thick. The facial suture in front of the eye runs S-shaped outwards and upwards, turns a little beneath the margin, and then runs straight across above the rostral shield; it bends out sharply beneath the eye, and cuts the margin beneath the most prominent curve of that organ. Rostral shield a long transverse piece, deeply striate, and overhanging with a sort of pouting lip the attachment of the hypostome. This last piece is yet undiscovered.* Cheeks with rounded angles posteriorly, and curving over the lower side of the head; they are separated by the wide rostral shield.

Thorax of 10 segments arched back, especially the forward ones, and having the three lobes just indicated by a very slight furrow where the fulcrum is placed, the subfusiform axis occupying more than two-thirds the entire width. The fulcrum is far outwards, and is formed by a short forward bend of each pleura, which then continues in the general direction, is sharpened anteriorly for rolling, and curves forward at its blunt end; the foremost pleuræ are rapidly shortened, the whole of the cheeks projecting beyond them (plate 3, f. 1**a*).

Tail in the young about three-fourths of a hemisphere; in the adult more than half. The upper corners are truncated and turned down, but there are no indications of the axal lobe. Incurved portion of the tail not broad, but thick, deeply concave, and marked concentrically on both surfaces by elevated lines of dots (pl. 4, f. 10, 10 *a*). The whole surface of the animal is more or less punctate, and marked with wavy imbricate lines; they appear to vary very much in number and position, abound near the edges of the head, but less so on its most convex portion; run across the thorax parallel to the course of the rings, and on the tail are most abundant on its forward margin. On all the articulating surfaces the lines are doubly close, but the puncta absent. On the somewhat depressed space immediately over the fulcral points in the head and thorax-rings, both lines and puncta vanish. These latter, which most probably indicate the bases of short pile, are often wide and deep (pl. 4, f. 3), and are present on the posterior surface of the tail, where the lines are absent. The inferior eyelid (pl. 3, f. 1**b*), if so it may be called, is deeply punctate in our specimen, but without any of the wavy lines.

Variations.—Though numerous specimens are extant, there are so few perfect ones, that we are not able to detect any considerable variety in the proportions. Certain Dudley specimens appear more elongate.

* Mr. John Gray of Dudley possesses an entire transverse labrum, with two tubercles, which very likely belongs to it.

Affinities.—But one is published which belongs to this section of the genus besides our own, the *Illænus trentonensis* of Emmons (Geol. New York, 2nd district), and through the kindness of Dr. Bigsby, the well-known explorer of the Canadian frontier, we have seen a specimen as large as our largest individuals of *I. Barriensis*, from Little Manitoulin Island, on Lake Huron. It differs, at a glance, from ours, in the angularity of the posterior angle of the head, and its strongly converging and lengthened axal furrows. Whether Dalman's *Nileus glomerinus*, described in 1828, be this species, as Burmeister thinks it may, we have no means of deciding at present.

History.—The earliest notice of the British fossil was given under the name of "A new Trilobite from Dudley," by Mr. Frederic Jukes, who communicated drawings and casts, and a note by Mr. J. de C. Sowerby, to Loudon's "Magazine of Natural History;" the specimens were obtained from near Barr Beacon, Staffordshire. Mr. Jukes also communicated casts soon after to Silliman, for his "American Journal," and it is there stated that Mr. Sowerby had referred it to a genus found at Trenton Falls, the *Isotelus* of Dekay. Professor Green, however, would not admit the identity of the two genera, and denied the existence of the English type in America. This was quite true at the time, but it is singular enough that the Trenton limestone should afford afterwards another and almost identical species. Sir R. I. Murchison, as is well known, founded his genus *Bumastus* on this Wenlock fossil. Milne Edwards did not adopt it, and considered it closely related to *Nileus;* while, however, he referred the other species of *Illænus* to Dekay's genus *Isotelus*. Burmeister, in 1842, placed it in its present position as a section of *Illænus;* while the species of *Nileus*, which Dalman distinguished from all trilobites (not knowing our species) by their want of trilobation, have fallen into their true position among the large group of *Asaphus*.

British Localities and Geological Range.—Silurian Rocks; Woolhope limestone to Wenlock limestone. Wenlock formations of Hay Head, near Barr, Staffordshire (Sir R. I. Murchison). Dudley, Staffordshire. Haven, near Aymestry, Herefordshire (Rev. T. T. Lewis). Woolhope limestone of Littlehope, Woolhope; and also of Nash Scar, Presteign, Herefordshire. Wenlock limestone of Ledbury, Malvern (Coll. Geol. Survey.)

Foreign Distribution.—Niagara group of New York (Hall). A species very like it was found near Hohenholm, by Eichwald (Urwelt, Russland, Heft, 2, 59), but it is not quoted from Norway or Sweden.

Explanation of Plate III.

Fig. 1. Old individual from Barr, in the possession of Miss Jukes, of Birmingham.

Fig. 1*. Side view of the same, showing the shortened foremost pleuræ (*a*), and the inferior eyelid (*b*).

Fig. 2. Side view from a fine coiled specimen in the cabinet of John Gray, Esq., Dudley.

Figs. 3, 3*. Two views of a young one; in the cabinet of Augustus Lewis, Esq.

Plate IV.

Fig. 1. The dissected figure. *a*, head; *b b*, cheeks; *c*, thorax segments; *d*, tail.

Fig. 2. Portion of surface above the eye, showing the wavy lines and puncta.

Fig. 3. Ditto, with puncta larger than usual.

Fig. 4. Magnified pleuræ, with lines and puncta.

Fig. 5. Part of tail, the puncta only present over the hinder portion of it.

Fig. 6. Pleura magnified, showing the fulcrum *a*, the backward bend at *b*, the sharpened forward edge *c*.

Fig. 7. Large head from Littlehope.

Fig. 7*. The same, lower side. *a*, rostral shield; *b*, rostral suture (Burmeister).

Fig. 8. Shows the thickened portion of shell just above the eyelid at *a*; impression of it on the stone beneath at *b*. (In this specimen it is destitute of puncta.)

Fig. 9. Side view of part of tail; at *a*, the fulcral point; *b*, the articulating surface, with lines, but not puncta.

Fig. 10. Incurved portion of tail; the inward surface with elevated granulate lines.

Fig. 11. A ditto, magnified.

The specimens figured in this plate are in the Geological Survey Collection.

The section *Bumastus* is related to the more typical species of *Illænus*, just as *Nileus*, of Dalman, is to his *Asaphus palpebrosus*. The distinct trilobation has vanished, and the axis is so wide as to reach the fulcral point, and be nearly coincident with it. There is a slight backward bend of each pleura just before the fulcrum, which serves to steady the articulation of the piece behind by overhanging it a little, while this piece, in turn, overhangs the preceding at the fulcrum, precisely as in the articulation of the abdomen of the lobster and cray-fish. Beyond the fulcral point the pleura is always more or less sharpened, to pass under the preceding joint in the act of bending; and, as in this operation, the back is lengthened, and the soft parts of the axis would be exposed by the separation of the segments, a convex articular portion is added on the forward edge of each segment, which fills the gap, and retires beneath the preceding joint, when the animal is extended. This is the structure of all trilobites which have been observed to bend or roll, and it is similar to that met with in recent crustacea.

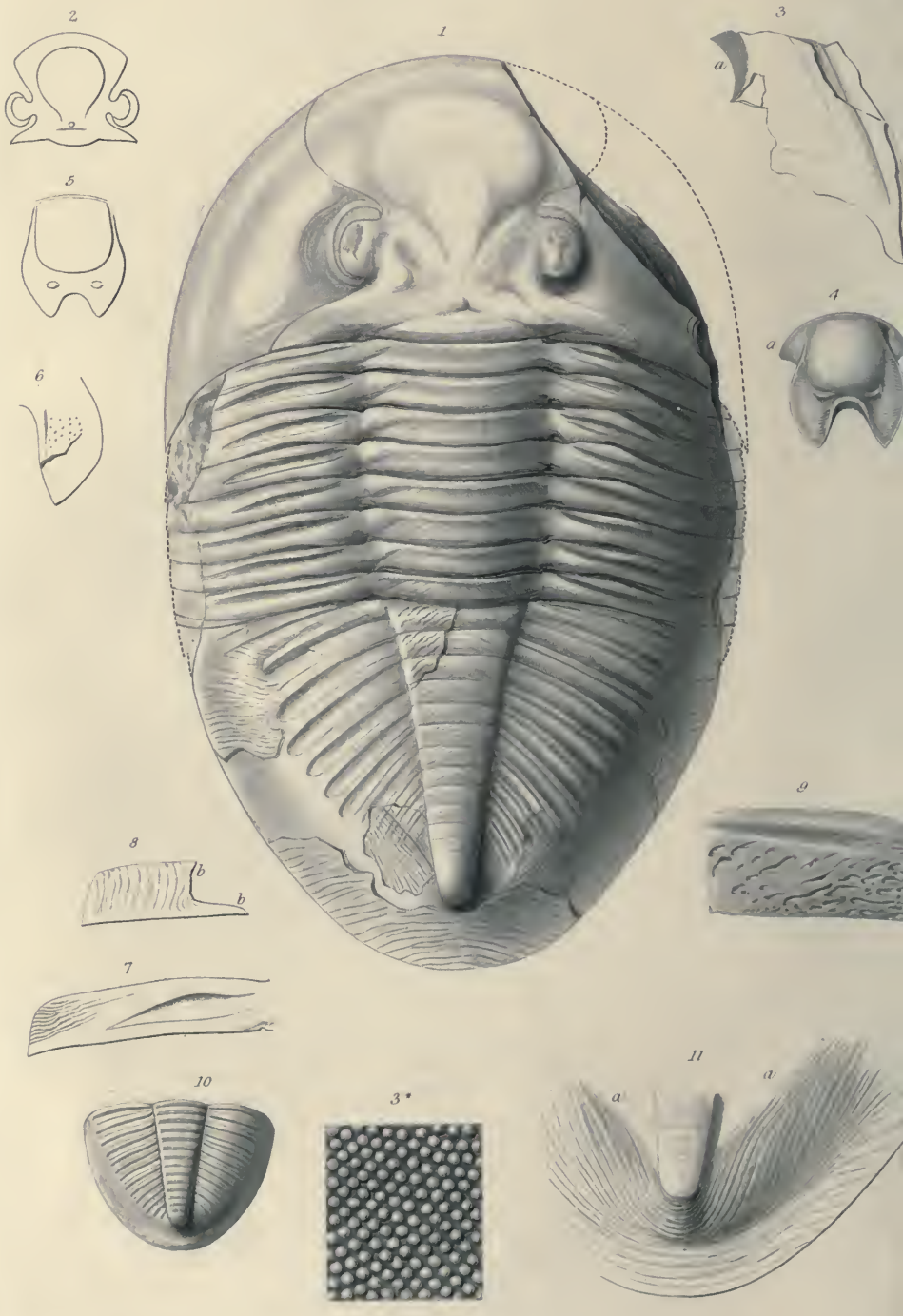
The subgenus is known in the Lower Silurian rocks of America, and the Upper Silurian of Britain.

J. W. Salter.

June, 1849.

Geological Survey of the United Kingdom.

ASAPHUS
(Silurian)



ASAPHUS TYRANNUS *Murchison*

BRITISH FOSSILS.

Decade II. Plate V.

ASAPHUS TYRANNUS.

[Genus ASAPHUS. Brongniart. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Eyes large, smooth. Facial suture marginal or supramarginal in front, and ending on the posterior margin. No rostral shield. Hypostome strongly bilobed. Body rings 8.]

[Subgenus *Basilicus*, Salter. Facial suture marginal in front; head but slightly lobed; pleuræ furrowed transversely; tail large, with axal and lateral furrows.

Diagnosis.—*A.* (*Basilicus*) *ovalis; capite semicirculari, angulis in spinas breves productis; cauda parabolicâ, latè marginatâ, regulariter convexa, apice rotundato nec acuto; axi distincto, sublineari, angusto, multicostato, apice abrupto; lateribus multicostatis.*

Synonyms. *Asaphus Tyrannus*, Murchison, Silurian Syst. (1837), pl. xxiv. and pl. xxv., f. 1. *Ogygia Tyrannus*, Emmerich, Dissert. (1839), 29. *Asaphus Tyrannus*, Milne Edwards, Crust. (1840), 3, 310. Emmerich, Leonhard and Broun's Neues Jahrbuch 1845 (translated in 'Scientific Memoirs,' vol. iv. (1845), 273). [not of Burmeister, Organ. Trilob. (1843), t. 5, f. 4. Ray edition (1846), 108.]

A remarkably perfect specimen in the cabinet of W. Day, Esq., of Hadlow near Uckfield, and specimens in the Geol. Survey collections displaying the parts of the mouth, enable us to present a complete description of this famous, but apparently local trilobite.

Description.—Length 11 inches; breadth 6¾ inches. General form nearly a true oval, moderately convex; the head semicircular, the tail longer and parabolic. Head smooth, with a slight concavity marking off the margin, produced at the angles into short spines which reach the third thoracic segment. Glabella clavate, defined in front only; the forehead lobe large, protuberant, and nearly round: beneath it, and at the level of the front of the eye, is the uppermost of three obscure oblique furrows. There is at the base of the glabella a tubercle, and beneath it an impression marking the place of the neck furrow. Eyes rather large, much arched, placed behind the middle of the head, and close to the glabella; the base of the eyelid is constricted, the lentiferous surface is broad and smooth, and beneath the cornea there are very

numerous lenses,* not quite closely set. Facial suture ending on the posterior margin, at the inner third of the width of the cheek, and in front of the eye turned outwards in a sigmoid curve; it cuts the front margin beyond the parallel of the eye, and continues exactly along the edge of the shield.

The hypostome is semicircular at its base, which is moderately broad; it has a squarish tumid centre surrounded by a strong furrow, and is deeply divided at the apex into two ovate-lanceolate forks, between which the shelly plate turns strongly inwards: there is an oval circumscribed tubercle at the origin of each, most distinct on the inner surface.

Thorax of eight moderately arched rings, the axis not strongly marked and as broad as the pleuræ; these latter are furrowed for three-fourths of their length, and are curved down, but scarcely bent backward, at the obscure fulcrum, which in the hinder rings is placed at about one-third away from the axis, but much nearer to it in the forward rings; the anterior edge of each pleura is sharpened, and its termination square.

Tail parabolic, its width at the broader end one-fourth greater than the length (it appears nearly equal), regularly convex, not sunk in the middle; axis flattened forwards and prominent behind, terminating abruptly at four-fifths the length of the tail, and ribbed throughout by about 15 furrows. The sides are furrowed for about half their width by 12 or 13 oblique parallel sulci, which end abruptly at the edge of the broad concave margin; the uppermost furrow is much stronger than the rest. The incurved lower surface of the tail occupies rather more than the breadth of the smooth upper border, and folds round the end of the axis which indents it. The fine lines on this incurved border are not truly concentric with the edge, but appear to branch from an imaginary line along the middle or most concave part. The space left between the upper and lower borders is shallow. On the upper crust of the tail the wavy lines are interrupted and inosculate; they arch over the axis with the convexity of the curve forwards: on the lateral lobes the curve is reversed.† The same arrangement is seen on the thorax rings,—at the ends of the pleuræ they turn upwards, and fig. 8 shows the longitudinal disposition of these lines on their under sides. On the head similar lines occur, but we have not specimens to show it well; the hypostome has them obliquely on the forks (fig. 4).

* On a specimen lent by Mr. Day, which presents only the lower half of the eye, the number and arrangement is such, that judging from analogy with *A. Powisii*, the eye of which is very much like this, there must have been 6000 lenses, or probably more.

† Burmeister has figured a good example of this arrangement of the sculptural lines on the tail of an *Asaphus* in his "Zeitung fur Zoologie," &c., 1 Band, 1848, t. 1, f. 19.

Variations.—Some individuals (perhaps females) are much more convex than others; in some the margin is abruptly concave; our figured specimen is depressed. The number of lateral ribs to the tail varies considerably, they do not seem to become more numerous by age. The forks of the hypostome are long or short. The ornamental lines which are so conspicuous in the external cast (Pl. 24, Sil. Syst.) exist, though less deeply sculptured, in all; the internal cast, which is more commonly found than perfect specimens, does not show them distinctly.

Affinities.—The specimen figured in Burmeister's work appears by his description to have been from a "boulder of red limestone," and hence it is very probably a worn specimen of *A. heros* (Dalman), from the red limestone of Kinnekülle, Gothland. It is unfortunate that the author should have transferred the sculpture of *A. tyrannus* to this figure, for the axis is constricted in the middle and depressed, and the lateral ribs long; it is in fact a pretty good figure of *A. heros*, except in the rounded tail; in Swedish specimens the tail is pointed and the axis percurrent. There is also a species in the lowest Silurian limestone of New York so like ours, that we do not know how it is distinguished; there are, however, but seven or eight distinct ribs on the axis, and those on the sides are said to be duplicate; we refer to *A. marginalis* (Hall), described in the Palæontol. New York. This is the more interesting, as the *Asaphi* of North America belong generally to the group *Isotelus*.* The species which most nearly resembles *A. tyrannus*, and which I referred to it in Prof. Sedgwick's papers in the "Geological Journal," is the *A. Powisii*, very common in the slates of North Wales. The specimen of this latter species figured in the "Sil. Syst." is much compressed, for the species is really more convex than that here described, with deeper furrows on the pleuræ, which are arched forward at their ends; and the tail axis is wide above, rapidly contracting in width and becoming quite indistinct, its end only prominent; the surface seems smooth; the sides of the tail have a very strong uppermost furrow; the remaining furrows are faint. Fine specimens of *A. Powisii*, in the collections of the Geol. Survey and of Mr. Sharpe, show very numerous lenses (about 7000) on each eye.

History.—It appears not to have attracted the notice of Llhwyd, although it is quite as common at Llandeilo as the *Ogygia Buchii*, of which he figured specimens; nor does it seem to have been noticed by any writer on trilobites previously to the publication of Sir R. I. Murchison's work. Emmerich, in his Dissertation, showed how close he considered its affinities to be with *Ogygia*, by transferring it to that

* The young animals of even this group, according to Hall's figure, are trilobed and ribbed in the tail; but that can only be in a very young state.

genus. In 1845, however, he restored it to *Asaphus*, though he evidently had not observed the characteristic labrum. Burmeister appears not to have been acquainted with the species, since in both editions he confounds it with what we believe to be a specimen of *A. heros*, and even suggests, in his Appendix, that Murchison's smaller figure might prove to be *A. extenuatus*. He notes that it appears anomalous for *Asaphus* to have such distinct ribs on the tail; and indeed this peculiarity is one of the indications of its affinity to *Ogygia*, which we think confirmed by the course of the facial suture.

Localities and Geological Position in Britain.—Llandeilo Flags.—Limestone of Wrae, Peebleshire? (Geol. Society's Coll.). Coniston limestone, Westmoreland? Craig-y-Glyn, Berwyn Mountains, in Bala limestone (Sedgwick); Meadow Town; Shelve, &c., in the Longmynd, Shropshire; Carneddau Hill, Builth, Radnorshire [J. W. S.]; Llandeilo, and many neighbouring localities in Caermarthenshire; Llampeter Felfry, Pembrokeshire [Murchison]; Narberth; Mydrim; Sholeshook; Lann Mill, Pembrokeshire (Phillips). It is remarkable that it does not occur in Ireland.

Foreign Distribution.—It is quoted by Sir R. I. Murchison from Northern Europe [Quart. Geol. Journal], but with the understanding that *A. heros*, Dalm., was intended. *A. marginalis*, Hall [Palæont. New York, pl. 4, *bis*, f. 15], may be the same as our species.

Explanation of Plate V.

Fig. 1. Perfect specimen. Llandeilo. (Collection of W. Day, Esq.)

Fig. 2. Outline of central portion of head, showing the constricted eyelids. Lann Mill.

Fig. 3. Portion of head, with the base of the eye, *a*. Llandeilo (Mr. Day's Collection).

Fig. 3*. Magnified portion of a cast from the same, which would represent the surface of the eye when the smooth cornea is removed.

Fig. 4. Perfect hypostome, with the upper processes (*a a*). Lann Mill.

Fig. 5. Variety of the hypostome, with shorter forks. Golden Grove.

Fig. 6. Punctate exterior surface of part of hypostome; the lineated surface is shown in fig. 4.

Fig. 7. Upper surface of a thorax joint. St. Clears.

Fig. 8. Under surface of ditto, showing the extent of the incurved portion *b*, *b*.

Fig. 9 Part of thorax of a large individual, with deep sculpture. Golden Grove, Llandeilo.

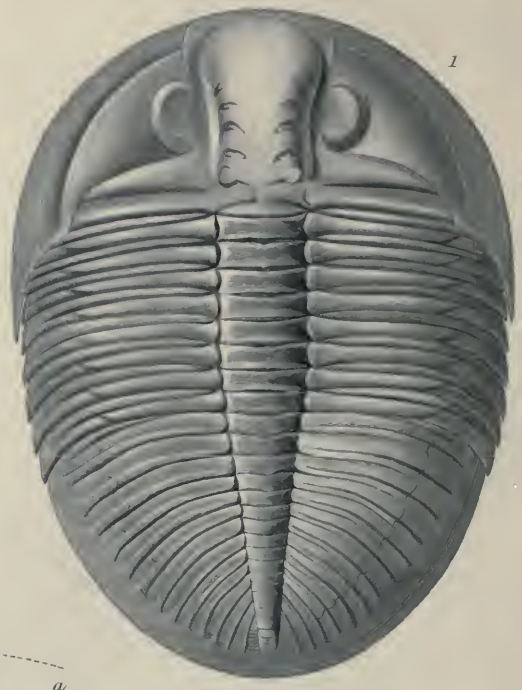
Fig. 10. Tail of young individual. Llandeilo.

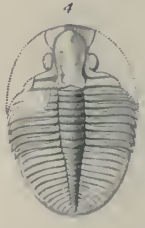
Fig. 11. Incurved part, under side of the tail, bounded by the lines *a*, *a*, and deeply indented by the axis. Clog-y-frain. (Sir R. I. Murchison's Cabinet.)

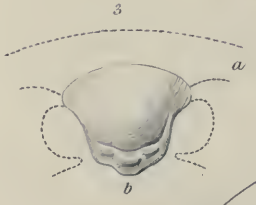
June, 1849. J. W. Salter.

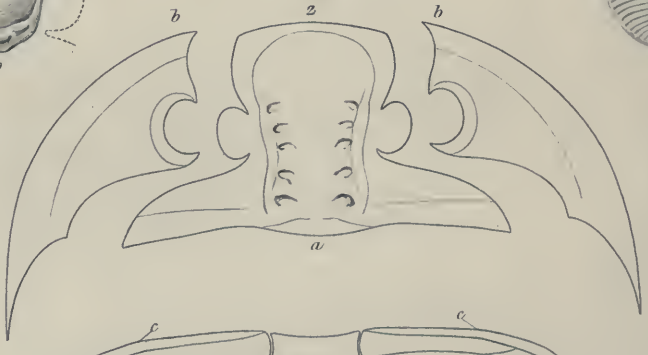
Geological Survey of the United Kingdom.

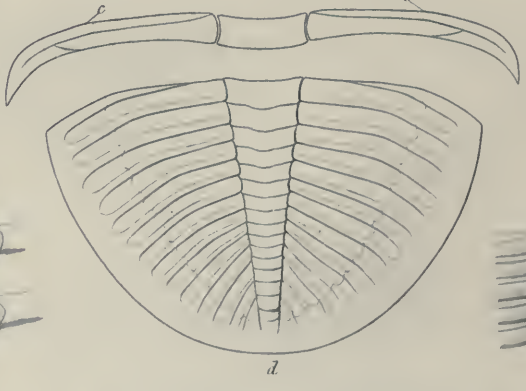
OCYCIA
(Silurian)

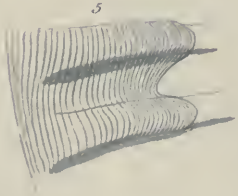












OCYCIA BUCHII — *Brongniart.*

BRITISH FOSSILS.

Decade II. Plate VI.

OGYGIA BUCHII.

[Genus OGYGIA. Brongniart. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Eyes large, smooth; facial suture cutting the posterior margin; no rostral shield or vertical suture; hypostome entire; body rings 8; tail large.]

Diagnosis. *O. ovalis, glabellâ angustâ utrinque quinquesulcatâ; oculis ad medium capitis; suturâ faciali ad frontem marginali; spinis posticis brevibus; hypostomate obtusè acuminato; thoracis axi bis pleurâ angustiore; caudæ axi longo abrupto; sulcis lateralibus* 12 *duplicatis, prope marginem angulatim deflexis.*

Synonyms. Llhwyd (1698), Philosoph. Transact., vol. xx., 279, tab. addit., f. 15. *Buglossa curta strigosa*, ib., Ichnograph. Brit. (1690), Epist. 1, t. 22, f. 2. Trilobite from Llanelly, Parkinson, Organ. Rem. (1811), v. iii., t. 17, f. 13. *Asaphus De Buchii*, Brongniart, Crust. Foss. (1822), t. 2, f. 2. *Trilob. De Buchii*, Schlotheim, Nachtr. (1823), ii., 34 (excl. the locality, "Norway.") *Asaph. Buchii*, Dalm. Palead. (1826), 68. J. D. C. Sowerby, in Loudon's Mag. Nat. Hist., 1829, vol. ii., f. 27. Buckland (1836), Bridgwater Treatise, t. 46, f. 7. Murchison (1837), Sil. Syst., t. 25, f. 2. Quenstedt, Wiegm. Archiv. (1837), vol. iii., 1, 346. Emmerich, Dissert. (1839), 28. Milne Edwards, Crust. (1840), 3, 309. Burmeister, *Org. Trilob.* (1843), t. 1, f. 2, [facial suture wrongly figured.] Ray edition (1846), p. 59. Corda, Böhm. Tril. (1847), t. 4, f. 39 [bad.]

——Junior. *Trinucleus? asaphoides*, Murchison, Sil. Syst., t. 23, f. 6. Milne Edwards, Crust., v. iii., 333.

Description.—Length occasionally near seven inches, generally three or four; proportion of length to breadth from 6 : 5 to 6 : 4, a considerable variation. General form a broad depressed oval, the head nearly semicircular and as long as the thorax, the tail semi-elliptical and longer than either; glabella at its base occupying one-fourth or less of the width of the head, broader and more convex above, and a little pointed in front; it extends nearly to the front margin, and is marked, a little within each side, by a longitudinal depression, which is curved with the convex side inwards. Along this hollow lie five pits, which represent the glabella furrows; the basal one is the neck furrow, that

above is placed near the centre of the glabella, the other three recede more, the uppermost coming just above the eye. Eyelid large, semicircular, and not touching the glabella. The facial suture above the eye is curved outwards a little to reach the margin, along which it runs for some distance; beneath the eye it curves largely outwards, and cuts the posterior edge just within the border. The latter is wide and striate, more or less concave, and marked off by a distinct marginal furrow. Eye placed halfway up the head, smooth, the lentiferous surface broad, its minute structure is not yet known. Head angles not produced below the fourth body segment. Hypostome broad above, narrowing below, where it is suddenly and obtusely pointed; the centre is gently raised, and a furrow runs down each side; there are two transverse furrows near the apex, with compressed tubercles between them. Thorax with the axis gently convex, variable in proportion, but seldom more than half the width of the pleuræ. These are flattened, furrowed along the upper margin as far as the fulcrum, at which there is an obtuse bend (fig. 2, *c*, *c*), the furrow diverges from the margin here, and does not quite reach the recurved and pointed extremity; it becomes widest immediately beneath the fulcrum, and from the lower margin of the pleuræ at this point a narrow ridge runs obliquely upwards, and meets it. Tail varying from little more than a semicircle to a half-ellipse, very gently convex; the axis gently tapering, ribbed by about 13 or 14 furrows, which have a downward bend in the middle; its obtuse tip projecting. Lateral furrows at nearly right angles to the axis, angularly bent downwards at the place of the fulcrum,* interlined all the way by fainter furrows, and leaving but a narrow flat margin. Incurved under portion of the tail narrow, closely striate, not indented by the axis; the upper side has a striate band of the same width, which is indented by every rib of the tail. The inferior striated band is continued (of the same width) along the ends of the pleuræ, and the striæ run in the same direction, while, on the upper surface, they are transverse, and reach further inwards. Numerous fine striæ, arched upwards, cover the axis. The cheeks appear to be nearly smooth, but the glabella is covered by fine, short, broken, almost microscopic lines. The hypostome is strongly and concentrically striate.

Variations.—It varies in convexity, proportionate length, and in the width of the axis; this latter is sometimes, though very rarely, more than half the breadth of the pleuræ—generally half, frequently less than half. A pair of tubercles on each segment of the axis is present; they are distinct and strong in some specimens (fig. 6), and faint in others.

* The tail, consisting of anchylosed segments, preserves traces of nearly all the characters of the thorax; the strong furrows are analogous to the furrows of the pleuræ, the fainter lines between them to the joints.

Affinities.—From *O. Guettardi* it is known by its less elongate and more oval shape, and greater width of pleuræ in proportion to the axis; in *O. Guettardi* they are but once and a-half the width. The axis of the tail is longer, and has 13 instead of 9 ribs, and is abrupt, not attenuated at the tip;—in *O. Guettardi* it extends but three-quarters the length. It has, also, duplicate, bent, and more numerous side furrows; the other has but eight or nine straight simple ones; the hypostome also is subconical, not dilated laterally. *O. dilatata*, Brunnich (not of Portlock), which seems to have been frequently held as a variety of *O. Buchii*, has the glabella short, with its lobes crowded down towards the lower part, and the eyes remote. The facial suture behind the eyes appears much less arched in Sars' figure. He also describes the tail as with 10 ribs, separated by *broad* furrows. The labrum of *O. dilatata*, according to Sars' figure, is but slightly different from that of the British species; but an important difference resides in the facial suture, which, in *O. dilatata*, is within the front margin on the upper side, but in *O. Buchii* is along the edge itself, as in *Asaphus Tyrannus.*

History.—The earliest mention we can find of Trilobites is concerning this species, and is that which all writers on these fossils have quoted. Mr. Edward Llhwyd, in a letter to Dr. Martin Lister, of the Royal Society (1698) writes "concerning several regularly figured stones lately found by him." "The 15th," he says, "we found near the Lhan Deilo*, in Caermardhinshire, in great plenty, it must, doubtless, be referred to the sceleton of some flat fish;" but, a few lines after, "Not that these, or any other marine terrestrial bodies were really parts of exuviæ of animals, but they bear the same relation to them as fossil shells to marine ones," &c. This latter opinion he takes care to maintain in his "Lithophylacii Brittanici Ichnographia" (1699), where he again says, the specimen represents only the skeleton of a sole fish, and wants the tail, and he marvels that the "Piscis Icon" should be raised above the surface of the stone, "ac si verus piscis esset." It is curious that Brongniart should have placed this species in his heterogenous group *Asaphus*, at the very time he was founding *Ogygia*, as he appears to have recognized the latter genus more by its marked habit than by any positive characters. He probably meant to unite *A. dilatatus* with *A. Buchii.* Dalman distinguished them, but with doubt, in 1826, and gave a figure of the Norwegian fossil from a plaster cast; and had not Sars, in 1835, given a complete description, and a good figure of

* Fig. 9, of the same communication, is often quoted as belonging to *Trinucleus.* We have no doubt it is *T. Caractaci*, as that is the common species there (*T. fimbriatus* is found at Builth) besides, the distinct dots in the fringe identify it with the former species. Fig. 8 appears never to have been quoted, yet it is a tolerable representation of *Cybele verrucosa*, Dalman, and it has been figured again without a name by Brongniart, plate 4, f. 11, from the same locality, where it abonnds, and is the only species of the genus there.

the head, the identity might still have been maintained. The hypostome of this species was first represented in Sir R. I. Murchison's figures. We have ascertained, by personal inspection, that the *Trinucleus Asaphoides* of his work is the young of *O. Buchii*. Quenstedt, 1837, unfortunately got hold of two specimens with seven rings; whether an accidental variety, or as Burmeister thinks, one occasioned by the slipping of one ring under the others, it is difficult to say. Quenstedt, however, relied on these, and Dalman's 7-ringed specimen of *O. dilatata*, and asserted the same number for *O. Guettardi*. But the error in both cases led him to see the generic affinity between these two allied species, and he distinctly says that their union with the typical *Asaphi* is unjustifiable. Burmeister, in his first edition, set the number of rings right, but confounded *O. dilatata*, which Sars had well distinguished in Oken's "Isis," (1835), with our species, and adhered to this view in the Ray edition (1846). Emmerich had, in the mean time, spoken of them as different species, and figured *O. dilatata* in Leonhard and Bronn's "Neues Jahrbuch," for 1845. Corda still maintains the error of the seven rings.

British Localities and Geological Range.—Llandeilo flags only. Not yet known in North Wales; the localities given for it in the "Geol. Journal," vol. i., p. 20, &c., are erroneous, and were stated to be so in vol. ii., p. 128. It abounds in the distorted slates at Shelve and Hope Mill, Shropshire (Sir R. I. Murchison); Rorrington, Middleton, and Meadowtown, Shropshire; Builth, Radnorshire; Llangadoc and Llandeilo, Caermarthenshire (Geol. Survey Coll.) Haverfordwest; Musclewick Bay, Pembrokeshire (Phillips). Not yet found in Ireland.

Foreign Distribution.—La Couyère, Bain, &c., near Rennes, in the Cotè d'or (M. Rouault). In the north of Europe *O. dilatata* takes its place.

Explanation of Plate VI.

Fig. 1. Perfect specimen from Builth (the glabella hardly pointed enough in front).

Fig. 2. Same specimen dissected; at *a* the slight ascending furrows which cross the neck segment are seen; *b b*, cheeks or wings; *c c*, fulcral points of the pleuræ; *d*, tail.

Fig. 3. Under side of head in front, with the hypostome *b* attached to the continuous under portion *a* of the cheeks; Builth.

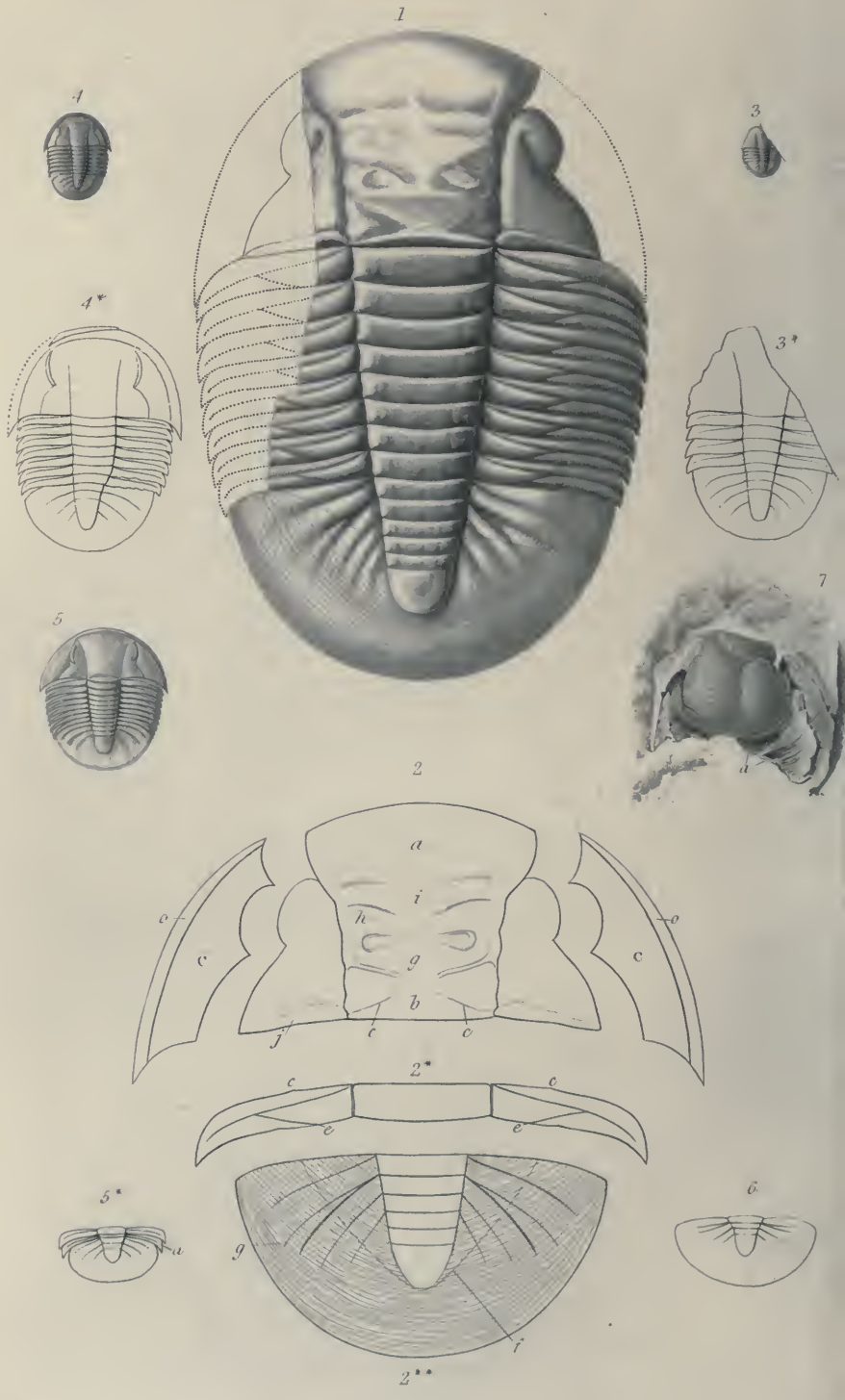
Fig. 4. Young specimen from Builth.

Fig. 5. Border of the tail, the inflected striate portion rendered wavy by projecting further inwards on each rib.

Fig. 6. Variety, with the tubercles on the axis strong; Llandeilo.

All the specimens in the Geological Survey Collections.

June, 1849. J. W. Salter.



OCYCIA PORTLOCKII — *Salter.*

BRITISH FOSSILS.

Decade II. Plate VII.

OGYGIA PORTLOCKII.

[Genus OGYGIA. Brongniart. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ). Eyes large, smooth; facial suture cutting the posterior margin; no rostral shield or vertical suture; hypostome entire; body rings 8; tail large.]

Diagnosis. *O. ovali-oblonga; capitis margine angusto; glabellâ genis latiore, obscuré lobatâ; oculis ad anteriorem partem capitis positis; sutura faciali ad frontem marginali; caudæ axi lato brevissimo.*

Synonyms. *Asaphus dilatatus*, Portlock (1832), Geol. Rep., Tyrone, &c., pl. 24, f. 2 (not of Dalman). *Ogygia dilatata*, Phillips, Memoirs Geol. Survey (June, 1848), vol. ii., pt. 1, 239.

Description.—Length 3½ inches; width 2½ inches; often larger. General form nearly flat, ovate, widest in front. Head forming rather more than á semicircle, considerably longer and wider than the tail, but about as long as the thorax; the glabella is as wide as the cheeks below, and separated by slight furrows from them; it widens and overhangs the eyes above, and is abruptly bent down in front, where the margin is hardly visible. For nearly two-thirds of its length the glabella is marked by lateral furrows, irregular in direction, dividing it (apparently) into four lobes, exclusive of the forehead and neck lobes. The neck lobe *b* is broad, and rises higher on each side than in the middle; it has two oblique sunk lines, *c c*, rising from the lower angles, which appear to divide it into a pair of lobes (*O. Buchii* has the same marking). Above this lobe lies the more contracted basal one *g*, which does not reach to the margin of the glabella. The second lobe, *h*, is wider and more oblique than the third, *i*, which is very faintly divided from the wide transverse forehead lobe *a*. The fourth lateral lobe, so distinctly marked in *O. Buchii*, is absent in this species. Eyes moderate, placed very high up, towards the termination of the facial suture on the margin; eye-lid semi-lunate, but not constricted above or below; eye line turning a little out above the eye, beneath it obliquely downwards and outwards, cutting the posterior margin at about half the cheek's width; wings moderately large, with a narrow border and a

small spine. Hypostome with the centre gently swelled, and with distinct concentric furrows on the sides; apex . . . . . ?

The first and last thorax rings are somewhat narrower than those of the middle; the axis is widest at top, and there only a little narrower than the pleuræ. It is not arched, but flattish, and marked by indistinct tubercles on the sides and middle. The pleuræ are straight; the fulcrum indistinctly marked about half-way along them; the divisions between the segments not nearly so conspicuous as the oblique straight furrow which reaches nearly to the end of each. The ends of the pleuræ are recurved and pointed, the foremost ones perhaps not quite so strongly as in our larger figure, the hinder ones as much as in fig. 2*.

Tail a semicircle, with the upper angles rounded off; the axis hardly more than two-thirds the length, flattened, conical, the end a little pointed. There are about five distinct ribs on the axis, each obscurely tritubercular. Lateral furrows four or five, very oblique, the two uppermost sharp and deep, reaching more than half across the side, with a secondary one between them, the two or three last very short and faint. Margin flat. Whole surface of tail crossed obliquely by lines which all run down from the upper angles inwards, except near the edge, where they are concentric; the incurved portion of the tail concentrically striate, broad, and indented by the axis. On the pleuræ the lines are longitudinal, and form a broad band crossing the segments. We do not know their direction on the head; the hypostome, however, is strongly marked by raised concentric threads.

Variations.—In the young state the middle lobe of the thorax and tail is narrower (of the latter considerably so), and therefore longer proportionally than in the adult; thus, in our smallest specimens, fig. 3, the pleuræ are once and a half as wide as the axis; in fig. 4, which is older, nearly as wide in proportion. In this stage the tail axis is not visibly annulated, but the number of lateral ribs is the same as in older specimens, about four; the upper one is not, however, duplicate. The glabella in the youngest specimens is very obscurely lobed, and the eyes are thrown even further forward, close to the very narrow border in front of the glabella. The latter is not incurved in front.

The most interesting point about these young *Ogygiæ* is, that they appear to confirm the supposition of the number of segments increasing with age. Fig. 3, the youngest, has but four segments to the thorax, and there is no appearance of displacement, the head is not shifted at all. In fig. 4, a little older, there are seven rings, nor can we think there is displacement in this case. The tail has turned a little, as on a pivot, pushing the front edge on one side a little under the last ring, but it has opened from that ring on the other side. Had a ring been shifted off, and lost in the stone, we might have expected to see an

impression of part of it on this exposed side—but there is none. And the probability that we have in this case the whole number of rings is strengthened by observing what takes place in one a little older, fig. 5*, for in this the last segment is very narrow, and appears to be in course of development.* We have no perfect very young specimens of *O. Buchii*, and therefore the point is still open to observation in this genus, in which occasional specimens have certainly been found with seven rings, as noticed by Quenstedt, Dalman, and Burmeister. The usual number is eight.

Affinities.—Its identification with *O. dilatata* by its discoverer, Portlock,† is easily understood by reference to his very imperfect original specimen, which he saw clearly was distinct from *O. Buchii*. With Dalman's figure, too, there is more similarity than with the better figures published since by Sars (Oken's "Isis," 1835), and Emmerich ("Scientific Memoirs," vol. iv.) Our species differs from the Swedish one essentially in the broad glabella, narrow head margin, and forward eyes. The proportions of the caudal axis and the lateral ribs of the tail are altogether different, but the above-mentioned characters of the head will suffice.

British Localities and Geological Range.—Llandeilo flags. Large and fine specimens were obtained in abundance at Newtown Head, Waterford; smaller ones are common at Builth, Radnorshire.

Foreign Distribution.—Not known. Dalman's figure of *A. dilatatus* is more like our species than the representations given by Sars and Emmerich, but we take it for granted these authors figure Brunnich's species, as their specimens were from Christiania.

Explanation of Plate VII.

Fig. 1. Large, but not full-grown individual. Newtown Head, Waterford.

Fig. 2. Same, or similar specimen, dissected.

[The letters on the head are placed in the order of those in the Mem. Geol. Survey, vol. ii., pt. 1, p. 334.]

a, Forehead, or front lobe; *b*, neck lobe, traversed by a pair of oblique lines *c c*, which mark the extent of the articulating surface of the first thorax joint; *g*, basal, or first lobe; *h*, middle, or second lobe; *i*, upper lobe, third; *j*, posterior margin, or lateral neck lobe; C, free cheek, or wing; *o*, margin.

Fig. 2*. Thorax ring of ditto; *c c*, place of fulcrum; *e*, an oblique line running upwards to the furrow (as in *O. Buchii*).

* We believe this increase in number is not a solitary case. The figured specimen of *Trinucleus Lloydii*, Murchison, has but five rings, and seems perfect. It may be peculiar to certain genera. Burmeister has suggested it in the case of *Paradoxides bohemicus*.

† We have great pleasure in dedicating the new species to Lieut.-Col. Portlock, whose careful and elaborate treatise on the Irish trilobites will be always valued by the British student. It was not only the best, but, at its publication, was the only English work containing extended views of the generic affinities.

Fig. 2**. Tail of ditto; *f*, line marking the edge of the thin incurved portion of tail [the lines that cover the tail in this figure are those of the upper surface]; *g*, intermediate furrow between 1st and 2nd.

Fig. 3. Youngest specimen, with four body rings. Builth.

Fig. 3*. The same magnified, to show the narrow caudal axis.

Fig. 4. One rather more advanced, with seven body rings. Builth.

Fig. 4*. The same, &c., magnified; shows the tail a little turned aside.

Fig. 5. Still older; the eyes very forward; eight rings. Builth.

Fig. 5*. The same, magnified: shows the last thorax segment as yet imperfectly developed *a*.

Fig. 6. Specimen of intermediate size, with short axis. Waterford.

Fig. 7. Imperfect hypostome; *a a*, concentric furrows. Waterford.

Note on the Genus.

The near affinity of *Ogygia* with *Brontes* has been perceived by Emmerich, who, in his excellent paper, "On the Morphology and Classification of Trilobites," * placed it next to that genus. The number of segments differs, 10 for *Brontes*, 8 for *Ogygia*; *Brontes*, too, is sometimes very convex, while *Ogygia* is flat; the shape of the glabella and caudal axis differ materially, and there was no genus known which could fill up the interval between the two genera. Both are expanded forms, characterized by large and strongly radiated tails, and flattened glabellæ, and by an obtuse, entire, furrowed hypostome. We are, therefore, fortunate in being able to publish a species of *Ogygia* whose characters link the genera much closer than before, and which, perhaps, might be regarded rather as a new generic form, but that its habit is quite that of *Ogygia*. If we knew more species of the genus, we would propose sub-genera for it, and might divide it into—

1. Glabella indistinctly lobed; facial suture within the margin. *O. Desmarestii*, Brongn. *O. Edwardsii*, Rouault.

2. Glabella distinctly lobed; facial suture within the margin. *O. dilatata*, Dalm.

3. Glabella narrow; facial suture on the margin. *O. Buchii*, Brongn. *O. Guettardi*, Brongn.

4. Glabella broad; facial suture marginal. *O. Portlockii*.

There are three or four undescribed British species of *Ogygia*, but at present we know them only by fragments.

J. W. Salter.

June, 1849.

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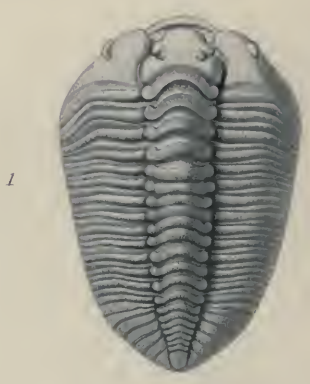
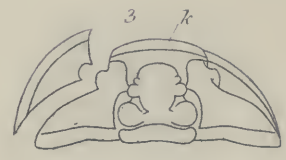
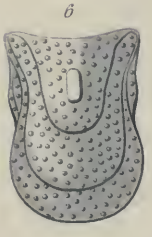
* Leonhard and Bronn's "N. Jahrbuch," 1845, translated in Taylor's "Scientific Memoirs," vol. iv.

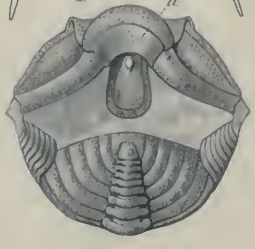
Geological Survey of the United Kingdom.

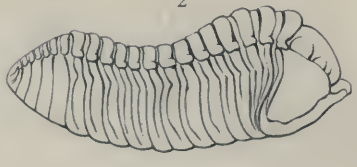
CALYMENE
(Silurian)











CALYMENE TUBERCULOSA *Salter*

BRITISH FOSSILS.

Decade II. Plate VIII.

CALYMENE TUBERCULOSA.

[Genus CALYMENE. Brongniart. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ). Axis distinct; glabella lobed, narrower anteriorly; facial suture dividing the posterior head angles, submarginal in front; a rostral shield; eyes supine (with a thin cornea?); thorax of 13 rings, formed for rolling.]

Diagnosis. *C. lata, depressa, alutacea; margine frontali capitis producto recurvo, genis gibbosis, glabellâ depressâ; thorace axi angusto, pleuris planis usque ad fulcrum, quod ad dimidium anteriùs, ad tertium posteriùs, positum est; caudâ latâ, superne depressâ, lateribus abrupte deflexis; axi conico, subplano, 7-8 annulato, costis lateralibus 5, planis, sulcis acutis.*

Synonyms. *C. Blumenbachii vera? a. tuberculosa*, Dalman (1828), p. 36? (not tab. 1, f. 2). *C. Blumenb., var. a. tuberculosa.* Hisinger (1837), Lethæa Suecica, 10? (not tab. 1, f. 3). *C. Blumenb.*, Murchison, (1839), Sil. Syst., pl. 7, f. 5 only. *C. tuberculosa*, Salter (June, 1848), "Memoirs of Geol. Survey," vol. ii. part 1, pl. 12.

Almost every author who has written on *Calymene Blumenbachii* has hinted his belief that two or more species were to be recognized among its protean forms; yet, except Colonel Portlock, who separated the *C. brevicapitata* in his report on the fossils of Tyrone, no one has done more than point out varieties. An extended examination of very numerous specimens convinced us that three distinct species were known in England, and their characters were detailed in the 2nd volume of the "Memoirs of the Geological Survey." Still further investigation of intermediate forms has shaken this opinion again, and we are at present wholly in doubt whether the striking differences about to be pointed out mark only a distinct variety, or are of specific value. At all events, in giving a typical species of this genus, we would rather present the reader with a new and well-marked form, than with one so familiar as that of the famous "Dudley fossil."

Description.—Length, about 2¼ inches, width, 1¼ inch. Whole surface equally and minutely scabrous. General form broad for the genus, not much attenuated posteriorly, depressed. Head short, wide; the

glabella not more prominent than the cheeks, and much narrower, contracted in front, and separated by a deep furrow from the front margin: it has three lobes on each side, the basal one large, the middle one nearly spherical, the third minute; the forehead lobe is small, the neck lobe large and prominent. The neck furrow is continued nearly to the posterior angles, which are rounded. Cheeks gibbous, often more elevated than the glabella, bearing the small eyes on their most prominent part. These are placed opposite the middle lobe of the glabella, and at some distance from it. A strong deep furrow separates the cheeks from the glabella, except opposite the eye, where a buttress is thrown across from the cheek, touching the middle glabellar lobe. The wings are strongly bent downwards, and even inwards on the under surface of the head, and the anterior margin is much recurved, and produced into a snout. On looking at the under view of the head, the margin appears greatly bent, and in the angle so formed the curved rostral shield, half as long as broad, is inserted; beneath this is attached the hypostome, which is squarish oblong with the terminal angles rounded, strongly convex forwards, the convexity terminating in a compressed tubercle; one or two concentric lines, as if of growth, mark the surface, which is also scabrous, like the general crust of the body. The axis of the 13 body rings is convex, but narrower than the pleuræ, and constantly tubercular on the sides. The pleuræ are horizontal half way, and then strongly decurved; their ends rounded posteriorly, and bent forward. Fulcrum distant from the axis, about half way from it near the head,—at one-third, or rather less, behind. Pleuræ sharply furrowed, the forward or fulcral half somewhat narrower than the posterior. Tail nearly semicircular, with the front angles truncated, evenly and gently convex, the axis not prominent, the sides decurved strongly towards their edges. Axis not percurrent, narrow, conical, with seven rings, and a terminal boss. Lateral ribs flattened, separated by sharp, narrow furrows, starting at a wide angle from the axis, and curved back on the sides, simple, or but rarely marked by a central line near their ends,—not bifurcate, as in *C. Blumenbachii*.

—— *Junior*.—The proportions of the axis to the sides and the structure of the pleuræ are similar, but the glabella is more cylindrical, not widened below; the tail is proportionally smaller, has the axis wider and more convex, with fewer ribs, and there are but four distinct ribs on each side. Fig. 8* is the tail of a young animal magnified.

Variations.—In some the axis is a little more prominent, in others a greater or less depression of the glabella occurs, and apparently the production forwards of the snout is not always in the same degree. But these variations are within narrow limits, and our species never seems to approach *C. Blumenbachii* in convexity, especially with regard

to the glabella and caudal axis. The front is constantly produced, the surface minutely scabrous, not covered with scattered tubercles, but this last character occurs in some varieties of *C. Blumenbachii*, which is more variable than we formerly believed.

Affinities.—It is distinguished from *C. Blumenbachii*, with which it has always been confounded, and to which it is closely allied, by the broad depressed form, narrow axis,* glabella not higher than the cheeks, distant fulcrum, and wide depressed tail; the produced recurved snout also is a strong character. *C. brevicapitata* has the snout recurved, but it is shorter; the axis is prominent, and the fulcrum close to it; the glabella also is much shorter and smaller in front, and the whole form is elongate and cylindrical. With the American species, as published by Green, Hall, and Emmons, it does not need a close comparison: *C. senaria* is attenuated posteriorly, and has a wide head, close fulcrum, and a small tail, with the axis as broad as the sides: *C. callicephala* is distinguished at once by the very short triangular glabella; it has also a close fulcrum. It is quite possible that hereafter forms may be found which will connect this species with the more common *C. Blumenbachii;* but at present we do not know such forms, and it is necessary to point out the obvious characters which distinguish them. Between *C. Blumenbachii*, however, and the other British species, *C. brevicapitata*, specimens intermediate in character, both as regards form and sculpture, have been discovered; the present species, therefore, being founded on somewhat similar kinds of variation, must be received with caution.

History.—The early figures and descriptions of animals of this genus had, of course, no reference to such minute differences as are now deemed necessary for specific character; however, there is one early figure which certainly resembles more the depressed tail of our species, with widely spreading and curved side ribs, than *C. Blumenbachii;* we mean that of Linnæus, "Stockholm Trans.," 1759, t. 1, f. 3.

Dalman describes, under *C. Blumenbachii*, three forms,† viz.:—

1. *Var. tuberculata*, in which he erroneously counts 12 segments to the thorax, and reckons about seven ribs to the tail. Length, 2 inches to 2¼. Gottland and England; the English specimen having the axis of the thorax tuberculate on the sides, as in the next variety.

2. *Var. Blumenbachii vera? a. tuberculosa*, with 13 segments, and tail with about eight ribs, the axis tuberculated on its sides; the head, tail, and lateral knobs of the axis closely scabrous; the dorsum (axis itself) smooth. Length about an inch. Gottland.

* There is a variety of *C. Blumenbachii*, with narrower axis, found at the Hollies, near Horderley, but the glabella and tail are normal, and the front not produced.

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3. *Var. Blumenbachii vera*, *β. pulchella*, "undique punctis elevatis sparsis," the axis hardly tuberculate at the sides; small. Gottland.

Of these three forms the first is the most doubtful. Dalman has probably given a figure of it, bad in all points of detail, in his table 1, fig. 2. This figure seems a little to resemble our species in the rather narrow axis, and distant fulcrum, and there is no indication of bifid ribs to the tail; however, the snout is not produced at all, the axis of the tail is also broad and convex, so that it probably is intended for the common species. Of his var. *pulchella* (tab. 1, fig. 3), we have seen specimens in the cabinet of Sir Roderick I. Murchison. They are dwarfs of *C. Blumenbachii*, and, like it, have scattered tubercles, a large glabella, and convex axis. But the description of var. 2 in so many respects agrees with the subject of our plate, that we have adopted the term *tuberculosa* as a specific name for it. The close minute scabrosity is particularly alluded to by Dalman. Even if the identification be incorrect, it will not involve any confusion of nomenclature. No recognizable figure of this species appeared till the publication of the "Silurian System," in which, at pl. 7, f. 5, a Burrington specimen is figured, and in the description the knots on the axis are mentioned as variable.

British Localities and Geological Position.—Wenlock shale to Upper Ludlow Rocks. Upper Silurian beds, Underbarrow, near Kendal, Westmoreland (Prof. Sedgwick). It abounds in nodules of the Wenlock shale at Burrington, Shropshire, from whence thousands of specimens have been distributed through collections. Small specimens are plentiful at Usk, Monmouthshire, in Upper Ludlow Rock; in neither case associated with the more common *C. Blumenbachii*.

Foreign Distribution.—There is much reason to believe, as before stated, that it occurs with the better known species in Gottland.

Explanation of Plate VIII.

Fig. 1. Full-grown specimen from Burrington; the head and tail a little bent down.

Fig. 1*. A specimen from the same locality, partially rolled up, but open sufficiently to show the hypostome or mouth-piece attached to the rostral shield *a*.

Fig. 2. Extended specimen from the same locality.

Fig. 3. Dissected head; *h* is the reflected front.

Fig. 4. Body segment separated, shows the nodular axis, and the distant fulcrum.

Fig. 5. Body segment seen in profile. It shows the depressed form of the body.

Fig. 6. Hypostome highly magnified.

Fig. 7. Magnified portion of the general surface.

Fig. 8. Young animal from Usk.

Fig. 8*a*. Tail of ditto magnified.

J. W. Salter.

June, 1849.

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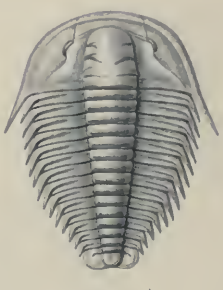

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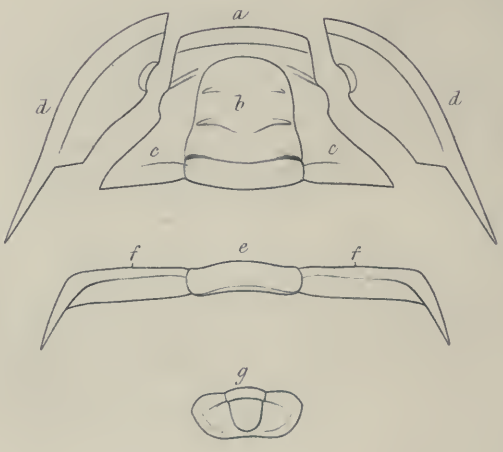

3

OLENUS MICRURUS *Salter.*

BRITISH FOSSILS.

Decade II. Plate IX.

OLENUS MICRURUS.

[Genus OLENUS. Dalman (in part). Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Glabella narrowed anteriorly, lobed; eye smooth, generally with a narrow prominent ridge connecting it with the upper part of the glabella; facial suture marginal in front, and cutting the posterior margin behind; no rostral shield; hypostome . . . . ? pleuræ 14, or fewer, pointed and recurved; tail with articulated axis and sides.]

[Sub-genus *Olenus*. Body rings 14; tail entire.]

Diagnosis. *O. ovatus posteriùs attenuatus; glabellâ genisque æqualibus; thorace segmentis* 14, *pleuris postremis axi angustioribus; caudâ transversâ integrâ, apice truncato, axi* 1-*annulato, lateribus unicostatis.*

In the course of surveying the barren country south of Snowdon, Mr. A. Selwyn, of the Geological Survey, discovered fine specimens of this new *Olenus*. They were found only at two or three localities in the lowest fossiliferous beds of the Silurian system, and may be considered, therefore, as the oldest British trilobites; they were associated with a species of *Eurypterus* and a *Lingula*. The discovery is the more interesting, as *Olenus* and *Paradoxides* are among the most ancient genera of trilobites in the Silurian rocks of the Continent. Other British species of the group have been described by Mr. John Phillips, from the black shales of Malvern.

Description.—Length, one inch three-eighths; width, seven-eighths. General form broadly obovate, acuminate posteriorly; the axis rather prominent, and the sides flattened. Head more than twice as wide as long, semicircular, with a narrow equal border, and produced at the posterior angles into moderate diverging spines. Glabella reaching very nearly to the front margin, bell-shaped, not very convex, but a little swelled below, with a narrow neck lobe, and two lateral lobes. Cheeks a little wider than the glabella. Eyes not large, forward, near the glabella, and connected with it by a slight oblique prominence. Eye line cutting the posterior margin far outwards. Pleuræ 14, flattish, increasing a little in width as far as the 6th segment, then shortened gradually, so that the two last are scarcely wider than the tail; each marked by an oblique shallow furrow, deeper near the tips, which are slightly recurved and produced into short spines. Axis narrowed pos-

teriorly, not so wide as the pleuræ in the anterior rings, but in the hinder ones wider than the pleuræ. Tail semicircular, truncate, the axis convex with one rib above, and about equal in width to the sides, which also have a single faint rib. Margin entire, slightly raised. But four specimens have been found, and all more or less distorted.

Affinities.—From *O. spinulosus*, with which the head has considerable resemblance, the entire truncate one-ribbed tail readily distinguishes it. *O. gibbosus*, besides having a triangular, many-ribbed tail, has the glabella not reaching nearly to the front margin, and the eye is placed at a distance from the glabella nearly equal to the diameter of the latter. In *O. micrurus* it is not above half the diameter distant. *O. alatus*, a small species, named by Dr. Boeck, has the glabella extended forwards, but it is very narrow and convex, and the eye is distant. The *Olenus gibbosus* (Corda), which, in shape of tail, is very different from Swedish specimens and Wahlenberg's description, differs from ours in the wide and ribbed tail, as well as in the general shape, which is oval, not attenuated; besides other points. We know of no other species with which it can be confounded.

British Localities and Geological Position.—Lowest Llandeilo flags (Lingula beds), Trawsfynydd, Merionethshire; Cwm-y-Swm mine, Dolgelly, ditto; Marchllyn Mawr, near Llanberis, Caernarvonshire.

Explanation of Plate IX.

Fig. 1. *Olenus micrurus.* Trawsfynydd.

Fig. 2. Same dissected. *a*, central lobe of the head,* including *b*, the glabella, and *c*, fixed cheeks; *d*, the mucronate wings; *e*, thorax segments, the obscure fuleral points are at *ff*; tail, *g*, with two-jointed axis, and single lateral furrow.

Fig. 3. Small specimen, Cwm-y-Swm mine, Dolgelly.

Note on the Genus.

The group of *Olenidæ* (Emmerich) includes genera which differ from each other in the course of the facial suture; in *Paradoxides* and *Olenus* its termination is on the posterior margin, and the wings or free cheeks are produced into spines. In *Peltura* (*P. scarabœoides*) and *Triarthrus*, it terminates in the posterior angle, or even a little above it, on the external margin, and the wings are very small, and by no means produced into spines.

Paradoxides differs from *Olenus* in the large and elavate, not bell-shaped, glabella; in possessing 16 to 20 body rings, and a minute tail, with its axis only articulate.

Olenus is divisible into two sections, if these do not merit the name of genera. 1. The group of true *Olenus*, to which our species belongs, having 14 body rings, and a tail with entire margin. 2. *O. spinulosus*, having fewer, about 12 body rings, and a spinose or laciniate tail; for the latter species, the sub-generic name *Parabolina*, in allusion to the shape of the glabella, might be appropriate.

June, 1849. J. W. Salter.

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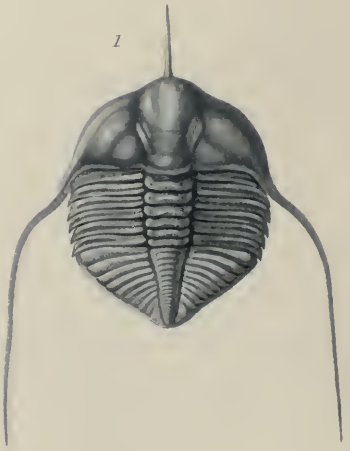
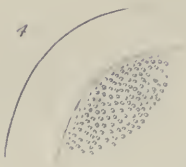
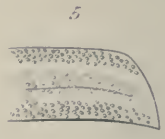
* Corda has proposed to call all this "glabella," and to distinguish it into central and lateral lobes.

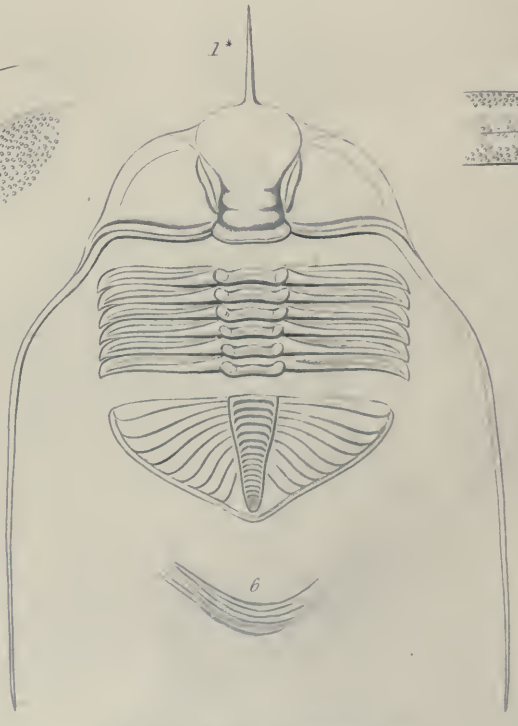
Geological Survey of the United Kingdom.

AMPYX
Silurian









AMPYX NUDUS *Murchison*

BRITISH FOSSILS.

Decade II. Plate X.

AMPYX NUDUS.

[Genus AMPYX. Dalman. (Sub-kingdom Articulata. Class Crustacea. Order Entomostraca. Family Trilobitæ.) Glabella tumid, armed with a frontal spine; head with simple, unexpanded margins; angles spinous; no facial suture; no eyes; body rings 5 or 6; tail entire-margined, margin deflected; hypostome?]

Diagnosis. *A. latus; capite semicirculari, spina frontali brevi; angulis longe-spinosis; glabella vix producta, lateribus bilobatis; thorace articulis* 6; *caudâ lateribus* 8—9 *sulcatis.*

Synonyms. *Trinucleus nudus*, Murchison (1839), "Sil. Syst.," p. 660, pl. 23, f. 5.

Description.—General outline broadly oval; body much depressed; the general axis, consisting of glabella, axis of thorax, and axis of tail, forming a lanceolate, convex, central elevation, narrowing posteriorly. Head, thorax, and tail of equal length. The first is rounded, with the outline, in front, slightly prominent, and the whole less than a semicircle; the last is slightly triangular. Glabella somewhat claviform, rounded and convex in front, narrowing behind the middle, and slightly widening out at its junction with the neck furrow; it is marked at each side by two or three indistinct furrows, and, towards its centre, by two very oblique furrows, which form small elliptical elevated spaces, one on each side, bounded by rounded and curved folds, below the level of the rest of the glabella, and appearing as if distinct from it. From the front of the glabella projects a slender subulate spine, which, in all examples hitherto met with, is rather less than the length of the head: it is not continued as a keel on the central surface of the glabella. The neck furrow is well marked, and the neck fold elevated. The cheeks are broad, depressed obliquely in their centres; the depression proceeds from near the upper extremity of the glabella lobes, and continues obliquely outwards, with an obscure curve towards, but not touching the margin. Between the depression and the hinder portion of the glabella the cheek is gently tumid, and likewise between the depression and the outer margin. The neck furrow runs straight and

close to the hinder margin of each cheek, leaving the edge elevated as a thickened and very narrow rim ; and then, at the angles of the head, making a slight curve, runs into and furrows the base of a long spine. This spine is of a subulate form, and projects backwards in a curved manner from the head angles, and at a distance equal to rather less than the breadth of the cheek, bends backwards and straight to more than the tail's length beyond the posterior extremity. No trace of a facial suture has been observed in any of the specimens as yet discovered.

The axis of the thorax is convex, and nearly equal in breadth throughout, very slightly narrowing at its junction with the tail. Its width is about two-thirds of that of the pleuræ. Each joint of the axis is deeply furrowed centrally, elevated anteriorly and posteriorly, the elevations of the proximate joints uniting to form a strong convex, somewhat curved, rounded rib, running across the axis, and terminated at each side by a conspicuous tubercle. Six such ribs mark as many thoracic articulations. The axis is separated from the pleuræ on each side by a deep but narrow groove. The pleuræ are straight, narrow, and depressed, tumid along their lengths on each side of a conspicuous deep oblique furrow; extremities obliquely truncated, slightly turned backwards. The surface of the tumid portions of the thorax, and also of the more convex parts of head and tail, are minutely granulated.

Tail triangular, with the sides slightly curved outwardly. Its axis prominent, gently tapering for nearly two-thirds of its length, then becoming parallel-sided, and ending obtusely at the termination of the tail. Nine ribs like those crossing the thoracic axis, but smaller and without marginal tubercles, cross the tapering portion of the axis; the remainder is ringed by numerous minute ribs. The axis of the tail is divided by a deeply-impressed furrow from the sides, which are gently convex, and grooved by eight strongly-marked lateral furrows, oblique, and curved slightly backward; the interspaces are tumid. The uppermost furrow commences at the junction of the tail with the body, and proceeds obliquely onwards to the margin, so as to leave a narrow, lanceolate, triangular space in front of it. The distance between its marginal extremity and that of the next furrow is greater than the distance between the extremities of any of the other furrows. The last and shortest furrow originates just above the termination of the tapering part of the tail-axis, and between it and the extremity is a smooth and slightly tumid triangular space. The margin of the tail has an elevated rim, the defleeted portion of which is striated.

Young specimens have the same number of thoracic joints with adult examples, and do not appear to differ materially in any respect.

The length, exclusive of the frontal spine, of the largest specimen examined, was one inch and three twelfths. The frontal spine measured

nearly five-twelfths. The breadth of the thorax was one inch. The length of a cheek-spine one inch and five-twelfths.

Affinities.—Its nearest ally is the *Ampyx mammillatus* of Sars (*A. Austinii* of Portlock), which it resembles in general outline, in form of head, and features of glabella, and also in the number of thoracic rings. The tail of *Ampyx mammillatus* is, however, very differently shaped, and has only one lateral furrow on each side, and its axis is, in great part, smooth. There are also very material differences in the structure of the cheeks and pleuræ. *Ampyx nasutus* (Dalman), is described as having six articulations, but has a very prominent glabella protruding much beyond the cheeks, and a tail represented as smooth at the sides. The figure given by Dalman, however, so closely resembles the *Ampyx rostratus* of Sars (*A. Sarsii*, Portlock), that I am inclined to think that the fold on each side of the tail above the single lateral furrow was mistaken for a joint of the thorax, for in all the other species of *Ampyx* there are only five thoracic segments with the peculiar triangular outline of the head, which is so shaped in consequence of the great projection of the front of the glabella beyond the cheeks. These characters we see combined in *Ampyx rostratus, Ampyx Portlockii* (Barrande), *Ampyx bohemicus* of Hawle and Corda, and my *Ampyx parvulus*. The *Ampyx Bruckneri* of Boll has the same form of head, but the body of that species is unknown. If, in the end, all the five-ringed species should prove to have long heads, and those with six thoracic segments to have short and rounded ones, the latter section may be conveniently distinguished from the former as a subgenus, under the name of *Brachampyx*.

History.—This curious trilobite was discovered by Sir Roderick Murchison, and figured by him in the Silurian System as a species of *Trinucleus*, of which genus he considered it a member, supposing the border of the head to be lost, and regarded it as allied to his *Trinucleus fimbriatus*, but as differing in the number of ribs on the tail. In 1845, a number of specimens were found in the original locality at Builth by Sir Henry de la Beche and myself, in more perfect condition than those first figured, and they proved, without question, to belong to the genus *Ampyx*. On examination of the original specimens figured in the Silurian System, I found that they also exhibited traces of the frontal spine. The true generic position of this trilobite was afterwards indicated in a note to the Ray edition of "Burmeister's Essay;" that author had regarded it as a mutilated example of *Trinucleus fimbriatus*.

British Localities and Geological Ranges.—Hitherto this *Ampyx* has occurred only in the Llandeilo Flags of Carneddau Hill, near Builth, Radnorshire, South Wales.

Explanation of Plate X.

Fig. 1. Figure of the entire trilobite, slightly restored, from the Builth specimen. All the parts are shown in specimens in the collection of the Geological Survey.

Fig. 1*. Dissection of the species. Lines as if of a facial suture are seen on the glabella, but they do not seem to indicate any true separation of parts.

Fig. 2. An individual still younger.

Fig. 3. A small specimen, showing the constancy of its characters at an early stage.

Fig. 4. Granulation of the head.

Fig. 5. Granulation as seen towards the extremity of one of the pleuræ.

Fig. 6. Lineation of deflected surface of tail margin.

Note on the British Species of Ampyx.

The genus *Ampyx* was first recognized as British by Lieut.-Colonel Portlock, R.E., who described and figured two species, *Ampyx Austinii*, identical with *A. mammillatus* (Sars), and *Ampyx Sarsii*, identical with *A. rostratus* (Sars), and probably with *A. nasutus* (Dalman). Both these forms were discovered during the researches of the Ordnance Geological Survey in Ireland, the former in the Silurian slates of Tyrone, and the latter in those of Newtown, near Waterford. Recent researches have led to the conclusion that the strata in which these fossils were found are members of the lower (Llandeilo or Bala) division of the Silurian rocks.

In Great Britain neither of these species of *Ampyx* have, as yet, occurred. The only species described as British, besides that now figured, is my *Ampyx parvulus*, from the Lower Ludlow of Vennal Hill (Mem. Geol. Surv., vol. ii. pt. 2, p. 350, pl. x.) There appears, however, to exist a third species in the Rhiwlas limestone, near Bala; one distinct from any as yet described, but of which only heads and tails have been found. The largest head is half an inch in length, exclusive of the spine. It is nearly allied to *A. rostratus*, but differs in having much smaller cheeks in proportion to the glabella, which is even more produced than in the *rostratus*, and exceedingly tumid. The cheeks in the species to which I have compared it are beyond the middle of the glabella; in the Rhiwlas form never so far as that part. The neck lobe of the latter is narrow, and the tail, though similar in sculpture, much shorter and wider. The proportions of the cheeks and glabella remind us of *A. Bruckneri* (Boll in Dunker and Von Meyer's Palæontographica, 1st Band, 11 lief., t. xvii., f. 8), but that species has a carinated glabella, and very broad neck lobe. *Ampyx Portlockii* (Barrande), is said to have the glabella much less elongated than *A. nasutus*, and therefore cannot be the Rhiwlas form. *A. bohemicus* (Hawle and Corda, t. 3, f. 19), comes nearer, but is represented as having a much wider glabella and a proportionately much smaller tail, with no traces of rings on its axis. I propose to name the Rhiwlas species, *Ampyx tumidus*.

Ampyx baccatus, of Portlock, does not belong to this genus.

E. Forbes.

July, 1849.

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